GOVERNMENT OF INDIA

ARCHÆOLOGICAL SURVEY OF INDIA

CENTRAL ARCHÆOLOGICAL . LIBRARY

ACCESSION NO. 34963

CALL No. 529.0954/ Was.

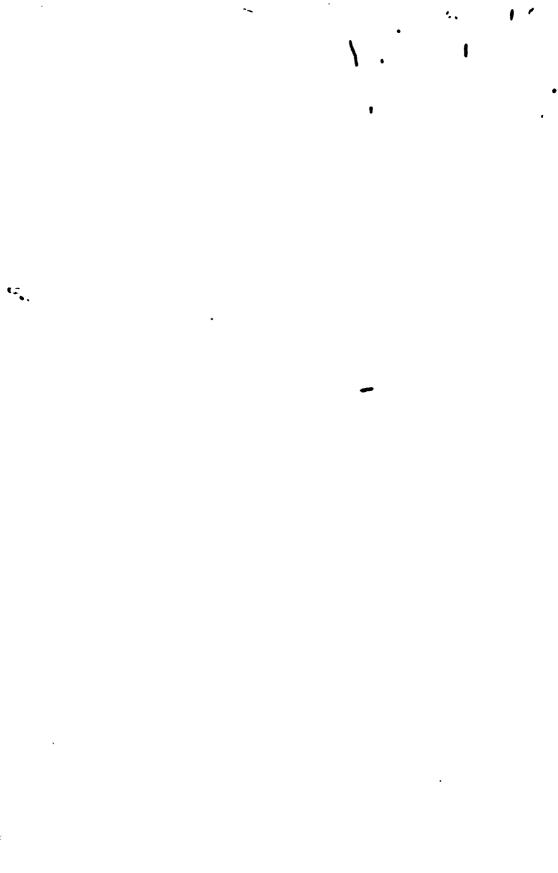
D.G.A. 79

Office of Dir. Genl. of Archæology.
SIMLA CENTRAL LIBRARY.

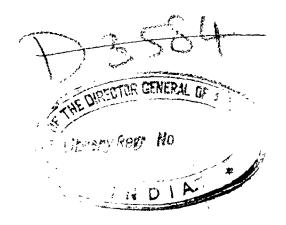
Division

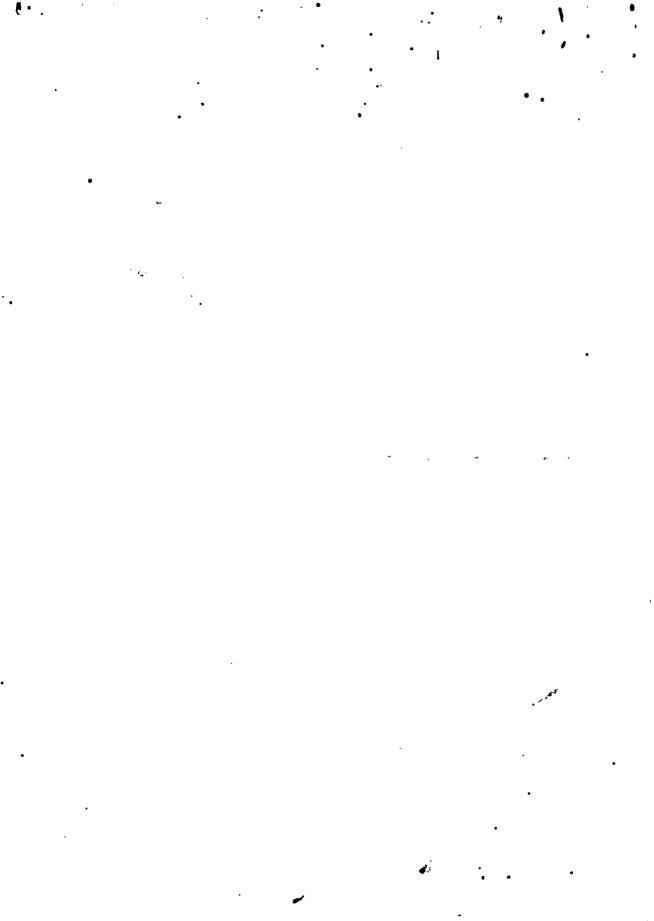
No-

Not to be assured out KALA SANKALITA A collection of the menois of the Vaious modes parts of India decided time: etc John Warren B Library Reg No 529.0954 War



KALA SANKALITA.





A COLLECTION

of'

MEMOIRS

ON THE VARIOUS MODES

ACCORDING TO WHICH

THE NATIONS OF THE

SOUTHERN PARTS OF INDIA

34963 DIVIDE TIME:

TO WHICH ARE ADDED,

Three General Tables, wherein may be found by mere inspection the beginning, character, and roots of the Tamul, Tellinga, and Mahammedan Civil Years, concurring, viz. the two former with the European Years of the XVIIth, XVIIIth and XIXth Centuries, and the latter with those from A. D. 622 (A. H. 1) to 1900.

529.0954

13 5

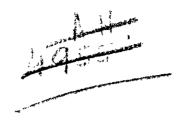
Z))

WOYLIEUTENANT COLONEL JOHN WARREN.

----- Si fortè lepos austera caucntes Deficit, eloquio victi, re vincimus ipsû.

MADRAS:

PRINTED AT THE COLLEGE PRESS .- 1825.





D 3584



1

-



TO THE

BOARD OF SUPERINTENDENCE

OF THE

COLLEGE OF FORT ST. GEORGE,

UNDER WHOSE AUSPICES AND PATRONAGE

IT WAS UNDERTAKEN AND COMPLETED,

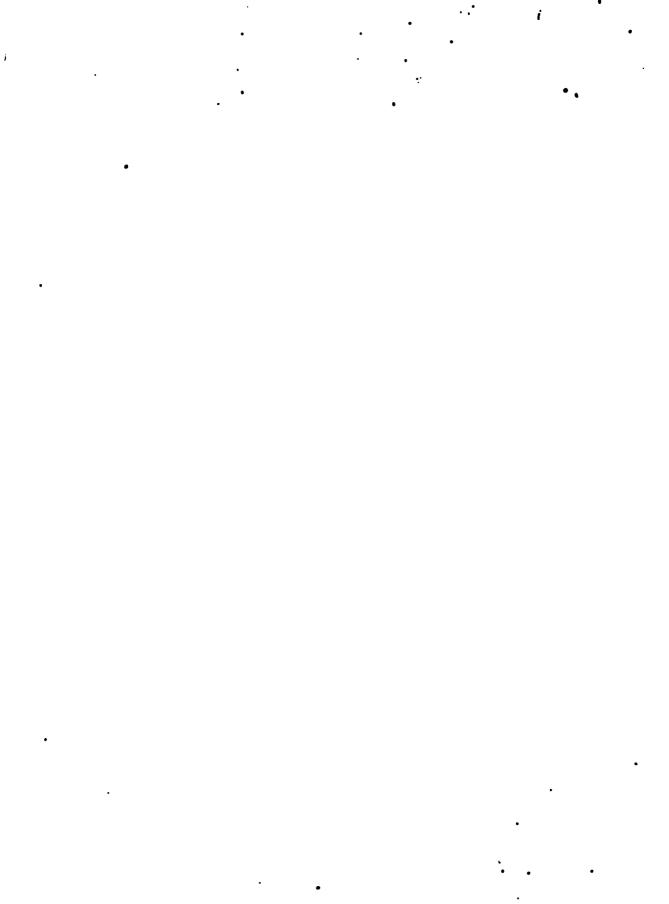
This Work,

IS RESPECTFULLY INSCRIBED

BY

The Author.

Madras, 26th February 1825.



XLIX F 16

PREFACE.

The present work, which has assumed a variety of shapes since it was first undertaken, was originally intended for the sole use of the Honorable Company's College of Fort. St. George. It was subsequently conceived that some of its Tables might be of service to Gentlemen employed in the Revenue and Judicial departments, and on that account the original manuscript (as far as it then extended) was purchased by Government in the year 1815: since that time it was considerably augmented, with a view to render it more deserving of the patronage it had received.

The irregular progress of the composition of these Memoirs, has unavoidably occasioned a defect in the arrangement of their parts, which the Author found subsequently impossible to remove entirely, and on that account he claims the reader's indulgence. The various employments which he held in His Majesty's Civil and Military services in different parts of the world, during eleven years that this work was in hand (though he admits, an insufficient excuse) may perhaps abate the rigour of criticism on what refers to style and method; and more than any other consideration, the circumstance of its having been originally undertaken at the call of private friendship and continued, after the object of it had ceased to exist, with the sole view of being serviceable to a public institution, without any prospective advantage to himself, will, the Author hopes, save him from the reproach of having rashly intruded his imperfect labours on the attention of the public.

The results of the present research can be of no sort of use to European Astronomy: they were derived from systems which we see no where supported by recorded observations, or modified (for several centuries past) by improved

theories. The Author begs it further to be understood, that these Memoirs are not designed to support or combate any doctrine or conjecture, on the past and present state of Hindu Astronomy; their chief object being merely to explain the various modes according to which the Natives of India divide time, in these southern provinces, and to render their Kalendars intelligible. These may, therefore, be properly considered rather as instruments contrived for Chronological purposes, than as Astronomical Tracts.

Each Memoir contains several Tables intended to abridge the tedious process of converting dates proposed according to European style, into the corresponding Tamul, Tellinga, and Mahommedan time, and vice versa.

The expediency of such an attempt was originally suggested by the late Mr. F. W. Ellis, Senior Member of the Board of Superintendence of the College of Fort St. George, who conceived that a work which would facilitate the comparison of the European and Hindu Chronologies, would be attended with the double advantage of relieving the Officers of Government from much uncertainty in the administration of public affairs, and at the same time of affording to the learned Natives of this part of India (some of whom are tolerably proficient in the English language) the means of acquiring the knowledge of our own methods of fixing epochs and recording events.

This conception was worthy of a Gentleman so well known to the Indian public for his powers of research, and enlarged views of administration; but he was not aware of the difficulties which surrounded its execution. At the time when he first proposed it to the Author, the knowledge of Hindu Astronomy was almost entirely extinct among the Natives of the Carnatic, and with very few exceptions, totally neglected by the Europeans. Some straggling Astrologers attached to the service of opulent Natives, and some obscure Almanac makers might, it is true, occasionally furnish a table, and a formulæ, such as were collected by La Loubére, Father Duchamp, Father Beschi, Le Gentil and others; but none were to be found capable of leading the Author into the obscure paths of Hindu Chronology or Astronomy; a case very different

from that of our learned cotemporaries in Bengal, who, whilst we were gleaning in a withered field for a few decayed materials, gathered ample stores from the collections of learned Natives and Brahminical institutions, not unassisted by well informed *Pundits*, *Mulavies* and *Jyautish Sastras*.

The labour of collecting and verifying the materials on which these Memoirs are founded was, therefore, much more considerable than was anticipated, and time and perseverance alone have enabled the Author to creek his work on authentic information.

The present production, if it fails in other respects, will at least serve to show nearly the present extent of our knowledge in Hindu Astronomy in these southern provinces, and in the absence of every other merit, the Author may perhaps be suffered to claim some credit for having been the first in the Carnatic, since the days of Beschi and Le Gentil who, unassisted, has endeavoured to draw the public attention on a subject of this nature.

Independently of his wishes to gratify the curiosity of Europeans, the Author had also in view (perhaps in a greater degree) to familiarize the learned Natives with the use of Tables constructed and disposed in the manner of those of the European Mathematicians; and also to reconcile them to the idea of brevity and expedition in computations, to which they are singularly averse, from a supposition that nothing can replace the entire exposition in figures of every part of the problems they are to resolve. In this attempt he found himself more successful than he had a right to expect—his Tables for the Ahargana of the Sun, Moon and Jupiter, intended to reduce the endless multiplications and divisions of the Sastra rules to addition and subtraction, and to elicit, by a short process, the number of days, and fractions of days expired from a given epoch to the time for which the computation is made. after due examination by the best informed Jyautish Sustras in Madris, have been pronounced "equivalent to the respective rules which they were intend-"ed to abridge," and they have manifested an intention of using them in future.

To the skill required for constructing the Tables referred to, the Author does not attach the least importance; these wanted neither depth of science nor ingenuity of contrivance; but what has gratified him was, to find a prejudice shaken which stood in the way of improvement, and a wish on the part of the better classes of the Natives (long since manifested in Bengal) to become better acquainted, than they were hitherto satisfied to be, with European doctrines and knowledge.

In order to avoid the risk of entering into scientific controversy, the Author has carefully avoided all dissertations which might lead him out of the confined scope which he has prescribed to himself. Whether modern (or sydereal) Astronomy was instituted so near to our times as the year of Christ 528, as some pretend, or whether its origin lies concealed in the obscurity of time, he shall not consider; but will expound the operation of the system now universally in use in India, as if it had ruled all past ages, and were to continue to do so to the end of time.

This assumption, although manifestly imaginary will, however, suffice for immediate purposes; for what public record can there fall under the cognizance of the Magistrate or of the Collector, that should bear an older date than the year of Christ 538?—and where is the probability that the ancient Tropical system (which is said to have been superseded at that epoch) will ever return into use among the Natives?

For the same reason, the Author will abstain from canvassing the opinions of learned cotemporaries on certain astronomical notions, which are affirmed and denied with equal confidence.

Whether, for instance, the supposed libration of the equinoctial points about the beginning of the fixed Hindu Zodiac (absurd as that notion no doubt is) proceeds from the error of European Scholiasts on certain passages of the Surriah, Vasist'ha, and Varasanita Siddhanta; or whether that doctrine be actually expressed with various modifications in the respective texts, is what he shall not pretend to determine: but, as Mr. Davis found that notion

established among the Jyautish Sastras at Benares, in the year 1786; Mr. Andrew Scott in the Northern Circars, in 1790, and the Author in the Carnatic, in 1814, without any difference of opinion among the Native Mathematicians, he thought himself justified in a practical work, when speaking of the Indian precessional variation, to use their own language; a compliance which is subject to no inconveniency, because even if it be supposed that the precession ceased to be retrograde in the year before Christ 6701, (as some will have it), the same theory does not admit that it can resume the same course before A. D. 7699, an Epoch so remote from the times in which we live, that it is a matter of perfect indifference to his present object, which of the contending parties has best understood the text; the more so, that the motion of the Equinoxes is supposed variable in neither doctrines, and that even those who support the system of libration admit neither decrement, nor increment, as it approaches to or recedes from its limits.

As this work rests on three distinct doctrines, viz. 1? What relates to the Tamul Solar year on the authority of the Aria Siddhanta. 2. What refers to the Luni-solar Astronomical year and Kalendar of the Tellingas, on that of the Surriah Siddhanta. 3. and lastly, what concerns the Mahommedan Kalendar on the Arabic system,—it was found indispensable to divide it into several parts.

The whole collectively taken, was denominated by some learned friends Kala Sankalita, a Sungscrete word signifying the doctrine of times. It presents (as far as the Author knows) the first attempt that was made in India to investigate and explain the elements of Hindu Astronomical Chronology, and to disclose to Europeans the contents and structure of those humble annual Kalendars which, written on palmyra leaves have, during nearly two centuries, been sold under their eyes without their even suspecting the skill and labour which their computation required.

• The first Memoir, called a Key to the Madhyama Saura Mana, contains an exposition of the mean Solar Sydereal year used by the Tamul inhabitants of the Peninsula of India. It shews 1? How its beginning, that of each of its months, and the rank of every day in the year and month, are to be determined,

according to Sydereal (by some called improperly Astronomical) or Civit' account. 29 How any date proposed in either of the old or new European styles may be converted into its corresponding Tamul date or theidy, and vice versa. There will be found at the end of the Volume certain Tables for resolving most cases referring to Solar time, without having recourse to the endless process of Native Astronomers.

Some parts of these theories, and of the three first Tables, were extracted from Father Beschi's tract on the Tamul time, which forms the 3? Appendix to his Dictionary.

The Key to the Madhyama Saura Mana-forms an indispensable introduction to the second Memoir, as it is impossible to compute the end of any Lunisolar year, month and day, without a previous knowledge of the concurring. Solar divisions of time, and as both are usually registered together in the Chandra Panchangum, or Luni-solar Kalendar. The Tables annexed to the first Memoir for the commutation of dates, will also serve for the second, with this only reservation, that if the date proposed be expressed solely in terms of Lunar tidhis, which depend on the Sun and Moon's relative motion (a case of very rare occurrence), then the Solar concurring day must be expounded by means not conveyed in the said Tables.

Two General Tables are given at the end of the Volume, the first of which refers principally to the Memoir on the Solar year. Besides other articles, it exhibits the beginning of each Tamul year reckoned from the beginning of the Cali yug, and the birth of Salivahana, concurring with the Christian years of the XVIIth, XVIIIth and XIXth centuries, according to the Julian and Gregorian styles, as far down as A. D. 1752, and to the latter only down to 1900. The Dominical Letters according to the two styles follow, and the initial feriæ and monthly dates, of beginning, as well as the roots of each year, are given in the two last columns, according to Hindu Sydereal and Civil accounts.

This Table gives also the names and ranks of the years of Jupiter's Cycle

of 60 years, agreeably to the three accounts of the Surriah Siddhaata, the Jyantistava, and that of the Tellingas, who make Japite,'s and the Solar year, equal: The two first accounts being followed in Bengal and the last in the Peninsula.

The numerals of the years of the Cycle of 90 years, used in the Tanjore, Travancore, Mudura and Tinnivelly provinces, are inserted in the 6th column.

In the second General Table will be found, the Christian years of the XVIIth, XVIIIth and XIXth centuries, with the concurring Luni-solar years of the Caliyug, their character, i.e. whether the year bea common or an intercalary one, the feriæ and monthly dates of the last conjunction of the year, when the ensuing year begins. The date of the same according to the Tamul Kalendars, and the Solar and Luni-solar Ahargana from which is deduced the juxta position of the beginning of the respective Solar and Luni-solar years. This Table, therefore, furnishes by mere inspection, the commencement of the Lunisolar year of the three centuries most wanted in present times, showing the day of the week, the monthly (Gregorian) date, and the Tamul Solar date of the same; and furthermore supplies the two elements first wanted for computing the beginning of every Solar and Luni-solar month and tidhi in any of the said proposed years.

The second Memoir, entitled a Key to the Siddhanta Chandra Mana (as it is called in the Peninsula), contains the theory and construction of the Lunisolar Astronomical year, on which hangs the whole fabric of Hindu Astronomy.

In analyzing and unfolding the construction of a Kalendar which seems to have been invented for the purpose of perplexing the Astronomer and confounding the Chronologist, the Author confesses that he had often to guess before he could demonstrate, and that he has been long groping in a dark and pathless heath before he could see clear before him, and decipher the columns of the common Patra, or Panchangum, which is sold and read in every village of India; for although the system on which it rests rules all the astronomical computations of the Hindoos,—governs their religious festivals and sacrifices,—the

expiatory ceremonies for the dead,—the agricultural dispositions which depend on the contingencies of the seasons,—and lastly, the endless train of superstitious observances, the epochs of which are determined by the science of Astrology (alike cherished by the Hindu and the Mussulman), yet the leading features of the Luni-solar Kalendar, are to this day much less understood by the Europeans who reside in this part of India, than any other measure of time used in any part of the world.

If it be considered that the doctrines on which these humble Kalendars are calculated, have from time immemorial ruled the Chronology of many civilized and wealthy nations, the subject of the second Memoir may not be deemed undeserving of the attention of the votaries of science. Its subdivisions treat of the following matter, and have in view, 1º To explain the principle and construction of the Luni-solar Kalendar, as it would be calculated for Lanca (if such a place were in existence), under the first Meridian and the Equator, and then to reduce the same to some other geographical position.

In the first division of the second Memoir, the computation of the different elements is explained according to the rules of the Surriah Siddhanta: a whole section is devoted to Hindu Gnomonics, the problems of which are indispensable for finding the true time of the circumstances of the year at any place which has longitude and latitude. The Trigonometrical demonstrations of the problems by which the Right Ascension, Declination, Longitude, Zenith Distance and Amplitude of the Asters are determined, will be found with Table XXX, page 36, 37 & 38 of the Tables, at the end of the Memoirs.

- 2º To determine the periods of mean interculations from which the true intercularly or expunged months due to certain Luni-solar years may be deduced.
- 3? The method of computing the various colleteral articles of the Lunisolar Kalendar, according to the Rules and Tables of Vavilala Cuchinna, an Indian Astronomer whose works are much esteemed and used in Tellingana.

This latter Section is exclusively the work of the late Mr. Andrew Scott, a Gentleman no less to be regretted for his amiable qualities, the uprightness of

his mind, and the simplicity of his manners, than for his extensive information in every branch of knowledge, and the liberality with which he imparted it to those who were qualified to benefit by his instructions. Some parts of this commentary might perhaps have been enlarged with a view to render it more accessible to persons not versed in Hindu Astronomy: but the author would have thought himself guilty of presumption had he pretended to improve any production that came from one whom he knew to be so eminently versed in the science.

The Tables which accompany the second Memoir, were procured from various sources. Those of Maracanda were borrowed from Mr. Davis' Memoir on the Astronomical computations of the Hindus. The Solar and Lunar Tables, also those of the Planets, are due to Mr. Scott's kindness. The Tables used for computing the Luni-solar Kalendar according to the precepts of Solar Astronomy (otherwise called the Vakiam process in the Peninsula) were furnished by Ruttani Audi Sashya Sastri, a Brahmin employed as Native Astronomer in the College of Fort St. George, to whom the Author owes a great part of the information he possesses on the construction of the Luni-solar Kalendar.

These three Tables are, he supposes, the same as were given to the public many years ago, by Father Duchamp, though he is not perfectly certain of the fact. They are now very scarce in this part of India, for it was with difficulty that those referred to were procured. The rest of the Tables were either obtained from native Indians, or constructed by the Author as occasion required.

The third Memoir refers to the Indian Cycle of 60 years, called by the Hindus, the Vrihaspati Chacra. It expounds the three different ways according to which it is computed; viz. the first according to the Surriah Siddhanta, (used north of the River Nermada)—the second on the precepts of the Jyautistava, a book on Astrology, used in some of the Northern Provinces of Bengal, but little known in Southern India—and the third being the Cycles used by the Tellingas, which merely consists of 60 solar years.

In the three above mentioned Memoirs the Author takes as data all that has appeared in Mr. Davis' two Tracts on the Astronomical computations of the Hindus in the second and third volumes of the Asiatic Researches. On the contrary, what appears new to him (though perhaps not so to certain scientific readers) he will endeavour to explain to the best of his abilities.

The fourth Memoir expounds the construction of the Mahommedan Lunar year, and furnishes a General Table (inserted after the Solar and Luni-solar Chronological Tables) shewing the commencement of every year of the Hejira, from the origin of the æra to the Lunar year corresponding with A. D 1909; according to the Julian Kalendar, as low down as the year 1582; and from thence according to both, down to the end of the Table.

The Appendix contains several Tracts, the first of which exhibits Tables for computing the Solar and Luni-solar Aharganas from an assumed epoch to any proposed instant of time, without having recourse to the rules of the Sastras. The second contains a particular method for expounding dates found on old inscriptions, the only vestiges of which may be either the name (or numeral) of the year according to some of the Hindu Styles, or the Sun's apparent place in the Hindu Sydereal Zodiac, at the time of the commemorated event. The third gives a short Chronological Tract, written for the purpose of facilitating the reduction of any date proposed according to Hindu Solar time, to the dates of the principal ancient and modern æras: and the fourth a specimen of the Hindu Kalendars and Ephemerides. Next follow four Fragments containing matter which may interest all sorts of Astronomers; after which the work concludes with a Glossary of the Sanscrit Astronomical terms contained in the text, of which it is also an Index.

The Author owes, perhaps, some apology for having extended in several instances, his speculations to very remote periods, both in past and future ages; the necessity, or even utility of which, are at first sight not very apparent. But those who are at all acquainted with any system of Astronomy, and particularly with that of the Hindus, need only be reminded that it would have been impos-

sible to attempt any construction or analysis depending thereon, without subjecting both to the test of time, in the revolution of ages, and what might appear to the uninformed a mere affectation of research and accuracy, will be judged by the former to arise out of the peculiar structure of a system of Astronomy, the correctness of which rests on the immense scope of its cycles and the vast intervals of its epochs.

This last consideration will indicate the quantum of labour which the present research has occasioned; for if it be considered that altho' most Hindu formulæ are very simple, even for the solution of the higher problems, yet the immense dimensions of certain quantities, expressed in natural numbers, and amounting in some cases to thirteen places of figures, renders for handling them, the use of Logarithms totally unavailable, and the European as well as the Hindu computers are compelled, in most cases, to remain satisfied with that perpetual and unwieldy instrument of Hindu Astronomy, the *Trirasica* (or rule of three) for expounding the minutest as well as the most comprehensive quantities.

It has been objected by some Gentlemen who have read these Memoirs in manuscript, that the Author has entered more deeply into the theories of Hindu Astronomy than was necessary in a work which referred principally to Chronology; but to this observation he may be permitted to answer, that for any Kalendar like those now used in Europe, where it was agreed to give to the months an arbitrary, but permanent duration, and to equate the years by certain periodical intercalations, the recurrence of which was clearly determined, there was no difficulty in devising a perpetual Kalendar for enabling any person tolerably well informed, to convert any date proposed in one style into another, without the assistance of theory.

But the case is quite different when referred to any sort of Hindu Kalendar, where there are hardly any instances of an arbitrary distribution of time, for excepting some occasional Cohepus (a constant number added or subtracted in certain computations to make the time fit a particular epoch) and some complementary fractions of days added to the beginning of certain Solar years,

in order to complete the time due to a given number of mean Solar revolutions, the course of the Asters remains as uninterrupted in the Kalendar as it is in their orbit.

As the singular form of the Indian Patras (or Kilendars) may be a matter of curiosity to Europeans, the Author has translated and inserted at the end of the volume, the first page of the Rivi and Chindra Panchangum (Solar and Luni-solar Kalendars) for the year of the Ciliyug 4926, coinciding with A. D. 1824, and containing the first month of the respective years, with their usual astrological appendage, both being unlike those of any other nation, ancient or moderu.

The Solar Kalendar is computed in Solar, and the Luni-solar in Sydereal time, and with different elements, which accounts for the difference of epochs assigned in each to the same phænomenæ (amounting sometimes to 8 hours and 58 minutes in plus or minus of European time), a circumstance which so operates, that the New Moon which is predicted in the one for a particular day, is, on the same spot, and computed perhaps by the same Astronomer, often registered for the next, in the other; a remark not to be neglected by Chronologists when they attempt to fix an epoch with precision by means of old Hindu Kalendars.

The Author readily admits that there must be many faults in the present production, some of which may perhaps not be deemed altogether excusable by those who are versed in Hindu Astronomy. Of the little merit it may possess it is not for him to speak, but he may aver, without offending truth or modesty, that he has neglected no pains to render it deserving of the patronage it has received, trusting that all liberal and candid readers will remember that in such matters,

" Optimus ille est qui minimis urgetur."

Before closing this introduction, the Author, in justice to the memory of the late Mr. Ellis, feels bound to record in this place, his acknowled ments of the personal assistance which he received from that Gentleman during the beginning of the present research, and the patronage of the Board, of which he was

the senior Member, which brought originally the work to the notice of Government. He stands under a similar obligation to Mr. Oliver and Mr. Richard Clarke, Mr. Ellis' successors in the superintendence of the College of Fort St. George.

His thanks are also due to Mr. Hyne of the H. C.'s Medical Service, (a Gentleman well qualified for the task) for his trouble in perusing and commenting the original manuscript, before it was ordered to be printed: and to R. Audy Shashya Brahmini, the Native Astronomer attached to the College, for his professional assistance during nearly two years that he communicated with him on the subject of these Memoirs.

Lastly, the Author embraces this opportunity for paying a last tribute of respect and gratitude to the memory of the late Mr. Andrew Scott, of the H. C.'s Civil Service, for many valuable and important communications in a science which in past times, he cultivated with success, and without whose assistance several of the papers contained in this collection could never have been completed.

MADRAS, 1st March, 1825.





 \times

* *

Those who only look in this Book for that sort of information which requires no labour, and is to be obtained by mere inspection, are referred to the Indian Chronological Tables inserted at the end of the Volume.

The Errata will be found after the Glossary.

TABLE OF CONTENTS.

FIRST MEMOIR.

A Key to the Madhyama Saura Mana, or mean Solar Sydereal year used by the Tamul inhabitants of the Peninsula of India.

PART I.

| Paze |
|---|
| SECTION I. Article 1. General account of the Solar Sydereal and Civil year, |
| Its beginning; when the Sun enters the Lunar mansion Aswina (ancient), or the Solar Sign |
| Mesha Y (modern),Civil and Sydereal account of time,The Seasons as disposed in pre- |
| sent times, |
| The Signs of the fixed Solar Sydereal Zodiac,—The Ecliptic,—the Equator,—Names of the |
| months according to the Surriah Siddhanta, -to the Tamul Astronomers, -to the Hindus |
| generally,-The space of time called a Day, variously considered, |
| Names of the subdivisions of the day, according to the Tamul Astronomers, Of the days |
| of the week,-Time which the Sun takes for moving through the Northern Signs,-through |
| the Southern Signs, The Civil Solar year of 365 and 366 natural days, |
| The feur Yugs, |
| Article 2. Duration of the Solar year according to the Northern Astronomers of the Penia- |
| sula, called Vachij 365° 15° 31' 15° (365° 6' 12' 30" European time) that of the A: ia Siddhanta, |
| -According to the Southern Astronomers called Sittandij 365d 155 31' 30° (3651 6° 12' 36" |
| European time), ib. |
| Rule for finding the number of days expired since the beginning of the Cali yug, called Ahar- |
| gana, according to the Tamul Astronomers, The feria, or weekly day on which the Solar year |
| commences, called the Soota dina, |
| The principal Hindu Meridian, that of Lanca; being the same as that of Oogein; its position, |
| The second that of Ramissuram,—The Tamul Astronomers refer to the former; several |
| Tellinga Astronomers to the latter, 9 |
| Article 3. On the manner of computing the beginning and duration of the twelve Solar months |
| • |
| of the year, and a cook a local law Heat life and is like and 19 |
| and the second second second second second |
| |
| to the European Kalendars, |

| | • | | | | | Page. |
|-----------------|------------------------|-------------------|------------------|------------------------|--|---------|
| Article 6. The | manner of numb | pering the Indi | an years of the | he Cali yug v | then referred | to |
| European acc | • | | ****** | ****** | 10741488 | 17 |
| Article 7. Of | the Æra of Saliva | than a , | 4>101111 | P****** | 4>4>1111 | 13 |
| Article 8. Of | the Era of Vicra | madity a, | ****** | ******* | ******* | ib. |
| Article 9. Pra | ctical manner of d | etermining the | commencemen | t of the Solar | year, | 19 |
| Section II. I | fow to expound | the initial feri | æ, or weekly | days, called | the Roots of | the |
| beginning of | the Solar year and | months, into | monthly dates | of the Christi | an Kalendars | for |
| any Epoch w | hatever, | 4,,,,,,,, | ******* | | 411#7*** | 20 |
| | Account of th | e Tables which | h refer to the | first Mem oir . | | |
| Of Table I, | 41195711 | <******* | 00750040 | # 21.06440 | ap+6+7<> | 21 |
| Of Table II, | 42001414 | ***** | 40,01*** | E:P84989 | ******* | 53 |
| Of Table III, | 4>4=55 | 4+501000 | ****** | ******* | ******* | 22 |
| Of Tables IV | and V, | **** | <.+* **** | 4000 4000 | \$194 160 5 | 23 |
| Of Table VI, | 02405013 | #108**** | **** | 9400 1160 | ****** | 24 |
| SECTION III. | Account of the T | ables continue | d, | **** **** | **** | 28 |
| Of Tables VII | and VIII, | 4144 446 4 | 41941111 | 4414444 | ****** | 29 |
| Of Table IX, | ****** | ****** | ******* | ****** | ****** | 30 |
| SECTION IV. | Memoranda, to be | referred to in | expounding d | lates,To no | tice whether | the |
| European da | te is likely to fall b | efore, or after | the beginning | of the first Hi | ndu month of | the |
| ycar,—And | if the given date fa | lls before the d | ay which begin | s the Christian | n ccutury, | . ib. |
| Notation of dat | tes in antecedentia, | or consequents | ia, how determ | ined,—Depen | ds on the num | ber |
| of Kalendar | days contained in | the preceding | , and current | month; not | on a common | or |
| bissextile yea | ar,—Various durat | ion of the Sol | ar months, hos | v to be determ | nined,—Notat | ion |
| - | i the Kalendar as a | • | ******* | ******* | 1-7417-9 | 31 |
| The reduction | of the Epochs to d | ifferent Geogra | iphical position | s postponed, | <************************************* | 32 |
| | | PAR | т и. | | | |
| Shewing how to | o convert European | into Hinda So | lar dates refer | red to the Me | ridian of Land | ra. 33 |
| | ions,-Example I, | | | | | |
| April 1745, | | ******* | ******* | | ******* | 34 |
| · · | r the Solar date wl | | ith the 1st Jar | nuary 1813. | ****** | 35 |
| | for the same answ | | | | D. 800. O. S. | |
| | , for the same ans | | | | • | , 37 |
| | r the same answeri | | | | | |
| | or the same success | | | | | UO |

CONTENT.S.

| | | | | A | | | Page. |
|-----------------|--------------------|-----------------|--------------------|----------------|-------------------------|----------------------|--------------|
| | VII, for the san | | to the date | of the birth | of our Savior | ir in the yea | |
| ~4 | the common Ære | - | t **** | ****** | ******* | ******* | 40 |
| Example | VIII, for that of | the total Ecl | ipse of the M | loon which oc | curred on the | 15th May 15 | |
| N. S., | ****** | | | .41798 | ****** | ****** | 41 |
| Exa mple | IX, what will be | e the Hindu S | Solar date of | an Eclipse of | f the Sun which | h is to occur | on |
| 44 \$ | th January 1899 | • | | | 15/41417 | ******* | 43 |
| Example | X, what was tha | it of the Solar | Eclipse wh | ich occurred o | on the 19th M | arch of the y | ear |
| 720 be | efore Christ at 6" | 48' p. m. (M | cridian of P | ris), | ******** | ******* | 45 |
| | | | PART I | II. | | | |
| For conve | erting dates prop | osed in Hindi | ı Solar, into | correspondia | ig European, | dates, accord | ing |
| <i>A</i> , | Julian and Greg | | • | ,,,,,,,, | | ******* | 47 |
| ₽ ? | I, the 1st day o | | · | ram (Bengal | Vaisácha' of | the 1748th y | еат |
| 7/1 | being preposed, v | | | | | | _ |
| k | Margali (Bengal) | | - | | | | |
| pondir | ng European date | O. S., | ******* | ***** | ****** | ******* | ib. |
| Example | III, the 20th 1 | Paratasi (Ber | ngal Aswina |) of the 1577 | th year Saca, | being propos | ied, |
| wanted | d its European co | rresponding e | late N. S., | ****** | ******* | ****** | 48 |
| Frample | IV, the 9th Cha | itram of the | 1603d y car | Saca, being p | roposed, want | ed its Europ | ean |
| concur | rring date O. S., | ******* | ******* | | 5111414 | ****** | 49 |
| Note. | On the Solar year | ir used in the | Southern | Provinces of | the Peninsula | , with a Cy | cle |
| of 90 y | years, called Grah | aparivrithi, | 00149948 | | 40101140 | ****** | 5 1 |
| Construc | ction of the Solar | r year,—Epo | och of the Æ | ra, the year | 21 before Chri | st,—Pre c ept | for |
| finding | g the cycles and | years,Evan | nple I, the | Hindu year | being propo s ed | l,—Example | II, |
| the E | uropean year beir | ig proposed, | ******* | ****** | ******** | ****** | 52 |
| Construc | ction of Table II, | Ahargana | ,—Atchù; | ın Epoch to | which a comp | outation is re | fer_ |
| red, | -Names and dura | tion of the n | nonths, sepa | rately and co | ollectively tak | eu according | to |
| the Sc | outhern account, | ****** | ****** | ******* | ****** | ****** | 53 |
| For the | Cycles,-For all | the years of | the Cycle, | Rules for fine | ding the beginn | ings of the 30 | ear s |
| by Ta | ble II,—To notic | ce whether, a | ıfter division | by 90 of the | numeral of the | e proposed y | e9 r |
| . of the | Caliyug, the re | mainder indi | cates an odd | or even year | : or the 40th | n or 80th of | the |
| Cycle | ,-Ilow to find l | y Table II | the commen | cement of the | Solar year of | the Cycle of | 90, |
| the ye | ear of the Cali ye | g being given | , either by F | European or I | lindu account | , | £ 1 |
| The Rul | les of the Northe | rn, and Sou | thern, Tamu | l Astronomer | s compared,- | -Examples I | ard |
| II, | ,, | 41/4100 | 40141549 | ****** | ****** | ****** | 5.5 |
| Example | es III and IV, | , ,,,,,,,, | ****** | B1411111 | ****** | 67581007 | 50 |

SECOND MEMOIR.

| A Key to | the Side | dhanta Chan | dra Mana | , or Hindu L | uni-solar | year, princip | pally used by | Page. |
|-----------------|-------------|---------------|--------------|----------------|-----------------------------|---------------|----------------|-------|
| • | | | • | hern Circars, | | 41743444 | | 57 |
| Advertise | | ****** | 27201249 | ***** | ***** | | ****** | 59 |
| | | | | PART I. | | | | |
| Article 1. | . Prepa | ratory opera | tions, | 4000 0104 | ****** | ******* | 41411110 | 63 |
| The Skele | ton of the | e Solar Kaler | ndar for the | proposed L | uni-solar | year to be | constructed, | and |
| c ertain | constant | quantities t | o be held r | eady for use, | | ****** | ****** | 65 |
| Skeleton | of the S | iddhanta Ch | andra Pane | changum for | the 492 | Ith year of t | the Cali yug c | om_ |
| puted fo | or the Me | eridian of M | adras, | ****** | ****** | ****** | ******* | 67 |
| Article 2. | Gener | al account of | f the Siddh | anta Pancha | เกฐแก, | Names of th | e Lunar mon | ths, |
| -Do. c | of the tw | o Pacshas, | or half Lu | nar months,- | _Duratio | n of the 12 S | Solar months | ac- |
| | | urriah Sidd. | | ***** | | | ******* | 69 |
| Ç- | | | - | the instant of | f tru e co nj | unction of th | e Sun and Mo | on, |
| | vasya T | idhi, the Lu | mar day of | the new M | loon, alwa | ys the 30th | of the month | ٠ |
| | - | | • | | | • | of the month | |
| | | | | eing the same | | • | ****** | 70 |
| Manner o | f dating l | tters and d | ocuments i | n Tellingana, | .—The di | Cerent charac | ters of the Lu | ıni. |
| solar ye | ar distin | guished by s | pecial term | s,-Sumvat | sara man | a, a common | year of 12 La | nai |
| months, | Adiga | h Sumvat sa | ra, an inter | rcalary year o | of 13 Lui | nar months,_ | | vat |
| - | | | • | | | | months, | |
| | | | | | | | r day, the int | |
| | | | | | | | -When no Ti | |
| | | | | | | - | r days, and | |
| | | | | | | | ongs to the So | |
| | | | | | | | intercalary | |
| | | | | | | | r and Luni-so | |
| days, | • | ****** | 49-20-0 | ****** | | 4110444 | 41771111 | 72 |
| • • | s registere | ed in the Ka | lendar acco | ording to Civi | il account | | | 73 |
| | | | | | | • | um,Of the | |
| | | | | | | | Nacshatras di | |
| | | , viguddias, | | | 1111-1 | 02004883 | ****** | ib. |
| | | | | | | | a; their nam | |
| | | | | | | | to correspon | |
| - . | | | | | | the Wurjun | | |

CONTENTS.

| Jum,—The Tcharum or Isharum, or aspect of the Planets on a giren day, Definition of a mean Tidhi, | | _ | | • | | | Page. |
|--|---------------------|--------------------------|-------------------|------------------|-------------------------|-----------------|------------|
| Article 3. Computation of the mean Elements for the end of any Tidhi, | jum, The Tch | arum or Ishar | rum, or aspect of | of the Planets | on a given day, | | 75 |
| Data,—Revolutions of the Sun, Moon and their Apogees in a Maha yug or in a Calpa,— Revolutions of the Equinoctial points in a Maha yug,—The Calpa, Sandii, Mantantaras, Maha yugs, and four lester yugs, and their durations,—Saura time expressed in degrees, 77 First Operation, for the Strostid Digona, or number of natural days expired on a giren Epoch since the beginning of the Calpa, | Definition of a mea | an Tidhi, | ****** | an++++ 44 | d>++++-0 | ******* | 7 6 |
| Revolutions of the Equinoctial points in a Maha yug,—The Calpa, Nandhi, Manvaniaras, Maha yugs, and four lester yugs, and their durations,—Saura time expressed in degrees, 77 First Operation, for the Strostidi Digona, or number of natural days expired on a giren Epoch since the beginning of the Calpa, | Article 3. Compa | atation of the | mean Elements | for the end of | any Tidhi, | ***** | ib. |
| Maha yugs, and four lester yugs, and their durations,—Saura time expressed in degrees, 77 First Operation, for the Strostidt Digona, or number of natural days expired on a given Epoch since the beginning of the Caipa, | Data,-Revolution | is of the Sun, | Moon and their | Apogees in | a Maha yug o | r in a Calp | α, |
| First Operation, for the Strostidi Digona, or number of natural days expired on a giren Epoch since the beginning of the Calpa, | Revolutions of | the Equinoctia | al points in a M | laha yug,The | Calpa, Sandhi | i, Manwanta | ıras, |
| Since the beginning of the Calpa, | Maha yugs, and | ${ m d}$ four lesser y | ugs, and their d | lurations,Sat | <i>cra</i> time express | ed in degree | s, 77 |
| Since the beginning of the Calpa, | First Operation, f | or the <i>Strostic</i> | di Digona, or n | umber of natur | al days expired | on a given Eq | och |
| Second Operation, for the Soota dina, or feriz on which falls the last conjunction of the Linisolar year, | | | • | | | ,,,,,,,,, | |
| Solar year, | | _ | | on which falls t | the last conjunct | tion of the L | ani. |
| For the Ahargana, | | | 84720477 | 0484444 | 4977**** | 2 ****** | |
| For the Ahargana, | Article 4. Telling | ga process for f | the Strostidi, | 4111114 | 4>>16416 | 4+++457+3 | ib. |
| Article 5. To find the Hindu Schar, and European, dates of the Scota dina,—The Ahargana for the last month of the Schar year during which the Luni schar year begins, to be computed, | | _ | E2824** | 401817 | 50744801 | 19/14749 | 80 |
| Article 5. To find the Hindu Schar, and European, dates of the Scota dina,—The Ahargana for the last month of the Schar year during which the Luni schar year begins, to be computed, | Soota dina, | | | | ********* | ****** | 81 |
| gana for the last month of the Selar year duting which the Luni solar year begins, to be computed, | Article 5. To fine | d the Hindu S | Salar, and Euro | pean, dutes of | the Scota din | a,_The Ah | ar. |
| computed, | | | | * | | | |
| Article 6. Third Operation, for the Sun's mean place in the Hindu Sydercal Zodiac,— Fourth Operation, Do. for the Moon,—Fifth Operation, for the place of the Sun's Aposee, | _ | ******* | • | - | • | ~ / | |
| Article 6. Third Operation, for the Sun's mean place in the Hindu Sydercal Zodiac,— Fourth Operation, Do. for the Moon,—Fifth Operation, for the place of the Sun's Aposee, | For the juxta posi- | ion of the be | ginning of the S | olar, and Lun | i-solar yenra, | ****** | 82 |
| Fourth Operation, Do. for the Moon,—Fifth Operation, for the place of the Sun's Aposee, | | | | | - | ercal Zodiac | |
| Eixth Operation, Do. for that of the Moon,—Seventh Operation, for the Agananea; or are of distance between the Vernal Equinoctial point, and the beginning of the Solar Zediac, 31 The Obliquity of the Ecliptic,—The Bhuja,—The mean Elements collected in one view, 55 Article 7. For the true or apparent Elements, and the Amavasya and Prathama Tidhis,—Eighth Operation, for the Sun's apparent place in the Sydereal Zodiac,—His Anomalistic Equation,—Area Bhagabala, | | | | | | | |
| of distance between the Vernal Equinoctial point, and the beginning of the Solar Zediac, 31 The Obliquity of the Ecliptic,—The Bhija,—The mean Elements collected in one vi. w, | | | | | | | • |
| The Obliquity of the Ecliptic,—The Bhuja,—The mean Elements collected in one view, 35 Article 7. For the true or apparent Elements, and the Amavasya and Prachama Tidhis,— Eighth Operation, for the Sun's apparent place in the Sydereal Zodiac,—His Anomalistic Equation,—Area Bhagabala, | | | | | | | |
| Article 7. For the true or apparent Elements, and the Amavasya and Prachama Tidhis,— Eighth Operation, for the Sun's apparent place in the Sydereal Zodiac,—His Anomalistic Equation,—Area Bhagabala, | | | | | | | |
| Eighth Operation, for the Sun's apparent place in the Sydereal Zodiac,—His Anomalistic Equation,—Area Bhagabala, | | | | | | | |
| Equation,—Area Bhagabala, | | | | | | | • |
| Ninth Operation, for the Sun's true motion,—Tenth Operation, for the Moon's apparent place and Anomalistic Equation, | | | | | | | |
| and Anomalistic Equation, | | | | | . for the Moon' | s annarent of | |
| Eleventh Operation, for the Moon's true motion,—Twelfth Operation, for the Sun and Moca's true distance, and relative motion, | | | | | | a mppareme p. | |
| true distance, and relative motion, 29 Thirteenth Operation, for the time due to distance, or instant of conjunction, 90 Article 8. Hindu Gnomonics, | | _ , | | | eration for the | San and Mac | |
| Thirteenth Operation, for the time due to distance, or instant of conjunction, 90 Article 8. Hindu Gnomonics, | | | | - | ŕ | | |
| Article 8. Hindu Gnomonics, io. Definitions, | | | • | | | | |
| Definitions, | | | mo due to dista | ande, or instant | or conjunctions | | |
| • | | | | | | | |
| Secured I Description of Vanly on France He construction Divisions Dimensions of | , | intion of Yank | u or Gnomen | Its construction | n Diricias | Dimension | |
| Section I.—Description of Sanku or Gnomon,—Its construction,—Divisions.—Dimensions of | | - | | | | | |
| Equatorial Circle and Parallels of Latitude,—Ratio of the Diameter to the discumference, 92 Rectical Rule for finding the dimensions of the Equatorial Circle in Pojanus,—Quantity used | | | | | | | , |
| 5059,3 Yolanas, 4 min. min. with the second terms of the second te | | | | | | —egiati (y ti | |

| | | | | 1 T | | Page. |
|----------------------|------------------|--------------------------|-----------------------|----------------|----------------|--------------|
| The Palabah, Pro | | | | | wae is given, | |
| Prollem 11, for th | | | | 41,41111 | ******* | 94 |
| Problem III, for the | | | | | en Latitude, | |
| Frollem IV, how | | | | | ******* | 95 |
| Problem V, (a repeti | tion of Proble | m II, referred | to Banda, and | the comment | ary on Vavila | ાંત |
| Cuchinna's Rules) | ,_Problem 1 | 71, for the Sun' | s Zenith Dista | nce or Natan | sa | 96 |
| Problem VII, for th | e Midday Sh | adow, or Mau | lhyam a Chya , | on any day | when the Sur | n's |
| Zenith distance wa | is observed,— | Problem VIII, | , for the length | of the Shado | w when the S | un |
| is East or West of | the Gnomon, | called Sama. | Iandala-Chya, | ****** | ****** | 97 |
| Problem IX, for the | e Ascensional | difference or | Chara Cumda, | _Problem 2 | Y, for the Sur | n's |
| Altitude at 10 dan | idas before, an | d after noon, | ****** | ******* | ****** | 98 |
| Problem XI, for the | time before or | r after noon, the | Altitude of th | e Pole, the Su | n's declinatio | n, |
| and his Altitude be | eing given, | 20151146 | £1941114 | 106042-5 | ****** | 100 |
| SECTION II. For th | e duration of | the natural da | y, and artifici | al day and ni | ght,The co | m- |
| putations referred | to the Tropica | l Zodiac,-Sur | r's declination | at I, II, and | III Signs, | 101 |
| Sun's Right Ascensi | on for the sam | e Signs,—San' | s Amplitade fo | r the same, | ******* | 102 |
| Sun's Ascensional d | lifference for t | the same,—For | the Oblique | Ascension or | Ullagna at a | ny |
| given place, | 40104048 | ******* | | ****** | ***** | 103 |
| Table of the Lagna. | , Chara Cumd | a, and Ullagn | , for the 12 Si | gns of the Ed | liptic comput | ted |
| for the Meridian o | of Madras,-F | For the Sun's di | arnal motion i | a oblique asce | ension, | . 104 |
| Length of the artiac | ial day, | £+0000 | 01110114 | A****** | 4 | 105 |
| Half the day, or Di | n Arda,-Hali | f the night, or | Ratri Arda,— | The day,—T | he night,—Tr | rue |
| time of Sun rising | ,-Time of Su | n setting, | 400000 | ****** | 4***** | 106 |
| Article 9. Reducti | ion of the end | d of the Amav | asya Tidhi at | Lanca, to a | ny Meridian | or |
| Latitudo, | 4+291747 | ******* | ****** | 21/41144 | ***** | 107 |
| True time of corju | nction after Su | in rise under th | e Meridian and | Latitude of | Madras,So | me |
| of the Moon's Eq | quations not co | nsidered in this | process, | ****** | ****** | 108 |
| Article 10. How | lo compute ser | iatim, all the T | Tidhis in the ye | ar, the end of | the last An | ≀ a - |
| vasya Tidhi, of th | | | | | ******* | 109 |
| End of the Prathan | na Tidhi,—Re | gistering the $T_{ m c}$ | idhi,—End of | the Vidya Tid | dhi,—Beginni | ing |
| of the Tadya Tid | | 41848-40 | -en-800so | ****** | ****** | 112 |
| Article 11. The Tie | dhis computed i | independently,- | Resolution of | a Cshaya Tid | dhi, or expuns | |
| Lunar day, - Nun | | | | | | |
| The Elements, | ****** | ****** | 84590866 | 417141111 | | 114 |
| Shortening the proce | ss,—Number o | of Tidhis expire | ed on the given | day, | ********** | 115 |
| | | | | | | |

| • | | | | | • | |
|-------------------|------------------------|-----------------|--------------------|---|----------------|-------|
| | | CONT | CENTS. | | | XX |
| Remainder to th | e conjunction | For the end | of the 29th Tid | hi.—Shewing | how the SOU | Page. |
| | dhi happens to b | | | | ******* | 116 |
| End of the 20th | | | | | of the column | |
| | The same proc | | | | | |
| the Malendar, | I ne same proc | ress applies to | (he lesolution (| 71 1110 111101 0111 | | |
| | | PΛ | RT II. | | | |
| Of the Solar or F | Zakiam process. | General acc | ount of this pr | ocess,The p | rimary Eleme | ents |
| of the Vakian | are those of the | a Aria Siddha | anta, | ******* | ******* | 118 |
| The Kalendar o | f the Solar year | concurring w | ith the Luni-sola | ar one to be c | onstructed, | The |
| Solar Aharga | na to be comput | ed, eicher by | the rule given at | page 8, or by T | Table XLVII | I, 11 |
| The Luni.solar | Ahargana to be c | computed by ti | ne rule given at p | page 80, or by | Table XLIX | .,120 |
| Article 1. Of | the Elements and | d their constru | action, | ******* | | ib, |
| Their generation | i,—The Sun's aj | pparent place | at his rising at l | Lauca,—the M | loon's,—Ano | ma- |
| listic revolution | on of the Moon,- | _The Devara | im of 218 days, | , | ******* | 121 |
| The Calanilam, | of 3031 days,- | The Raza-Gh | erica, of 12372 | days,—The $oldsymbol{V}_{oldsymbol{c}}$ | edam, of 1600 | 934 |
| days,—The C | handra Vakiam | Dhurmavan | kam, | ****** | 4 | 129 |
| For the argume | nt of the Moon' | s Equation,- | Elements of the | Sun's appare | ent place | . 123 |
| Article 2. Acc | count of the ${f V}$ a | ikiam Tables | ,-Of Table X | XVI, being | the first in | the |
| Vakiam proce | ess,The Moon' | 's Equation al | lways additive, | | ****** | ib |
| The Equation to | be always take | n for the Val | ciam day, or ar | gument found | by the operat | tion, |
| -The Moon' | 's motion to be to | aken for the r | iext day when th | e conjunction | is to come, | and |
| for the day its | self when it is pas | st,—Of Table | XXVII, being | the 2d of the | process called | the |
| Yoghiadi Tal | ole; of Part I, | ******* | 407 157 58 | ****** | ******* | 12- |
| Examples, | ******* | ****** | 4000:149 | entHip | ******* | 128 |
| Of Part II, | g.9641*1 | 21124711 | \$2,01043 | 80797479 | ******* | 127 |
| Examples, | ******* | 81001000 | BE 0 7 5 4 * 6 | ****** | ****** | 128 |
| | III, being the 3 | | ss,_Of Table | XLVII (thus 1 | numbered by | mis• |
| take) being th | e 4th of the pre | ocess, | 99500000 8010000 | , ,,,,,,, | ******* | 130 |
| Ezamples, | ******* | **** | ******* | *,**** | 44.70419 | 131 |
| Article 3. Re | solution of the la | est conjunction | n which ended th | ie 4923d Luni. | -solar year of | the |
| Caliyug, | | | | ****** | ****** | 132 |
| Moon's place u | ncorrected,_Ah | hargena 1st P | ooagoni (Benga | 1 Chaitra) of | the 4923d S | olar |

Reduction to the Longitude,—Last Equation answering to the Arca Ehagabala,—Moon's place corrected,—O and D's distance,—Relative motion,—True time of conjunction, 131

133

135

year, -Sun's place uncorrected, -Sun's place corrected,

Article 4. The same conjunction computed for Lanca,

| | | ** | • | | • | Page. |
|--------------------|------------------------|--|-------------------|---|--|-----------------|
| The results by the | | | | | ******* | 137 |
| Article 5. Resolu | | | | | | or |
| expanged month | | | | | | |
| occur,-The sam | _ | month,—Resolu | nion of the first | t Amavasya 1 | which determi | ines |
| a Cshaya month. | , ******** | ******* | *\$***** | ******* | ****** | ib. |
| Of the second, | 4,2414+1 | 955648 \$42658+1 | ***** | ******* | ******* | 1 10 |
| - , | | ******* | | ******* | ******* | 142 |
| Article 6. Resolu | itica of the tw | o Amuvasyas 🔻 | kich determine | the first int | ercalation du | e to |
| the year 4924 of | the Calipez, | ******* | ****** | •• | ****** | ib. |
| First Amavasya of | the first inter | calary month, | 8+24+44 | •••• | ******* | 143 |
| Second Do. | 11+++++ | 4.,,,,,,, | ****** | ****** | ******* | 144 |
| Conclusion, | 49+4+ *** | ***** | ****** | ******* | ***** | 146 |
| Norg. On the spec | cific name give | n to each Hindu | year, whether | Solar or Lu | ni-solar, 🛶 | 147 |
| | | PART | HT | | | |
| | | | | | | |
| On the Hindu met | hod of determi | ining the mean | Epochs of In | tercalation,- | -General viev | w of |
| the subject, | ****** | ****** | ******* | ****** | ****** | 149 |
| Article 1. Resolut | ion of mean int | tercalations by the | he Hindu rule, | ****** | ****** | 150 |
| Account of Table | XXIX, | ******* | ****** | ***** | ******* | 151 |
| Examples of its a | pplication, | ******* | ******* | 41111 | 1. | 51, 15 2 |
| Article 2. To fi | nd the me an pl | ace of the Moo | n's Apogee by | the Tables, | ******* | 153 |
| Rule of Vavilala | | | | | | ib. |
| Application of the | same,Concl | usion; of an ex | punged month | in the years | 4783, 4924, | and |
| | | 2730546 0535034 | | ****** | ******* | 155 |
| Proctical Cycles u | sed by the Tell | inga Astronome | rs for discove | ring when a (| Cshaya year i | is to |
| occur, 19, 141 | | | | | • | 156 |
| Article the last. | Resolution of | the double inter | calation with a | ın expunged i | nonth which | is to |
| | | present times red | | | | |
| by the Pakiam | | | 4114) | ••••••••••••••••••••••••••••••••••••••• | ****** | |
| Section 1. The | Elements of th | e 1st conjunction | n which marks | the end of | | anth |
| Carries, of the | 5065th year o | f the Call yag, | 41141111 | | cae Bunar m | ib. |
| Section II. See | | | t an | **** | •••••• | |
| Sucrios III. Th | | | | | de of Made | 158 |
| SECTION IV. Fo | or the time of a | ue San rising en | the days of se | ninnetian | de or madra | |
| Cenclusion, -Ob | servation. | ennen | inc days or co | | •••••••••••••••••••••••••••••••••••••• | 160 |
| | , | V | £41444F3 | G972444 | | 164 |

APPENDIX

To the Key to the Siddhanta Chandra Mana; being a commentary on Vavilala Cuchinna's Rules and Tables, for computing the Tellinga Kalendar.

PART I.

| Notice, | **** | 40741349 | ******* | ******* | ***** | 1 09 |
|-----------------|-----------------------------|-------------------|-----------------|------------------|-----------------|--------------|
| Rules and Tal | bles, &c. $-\Gamma_{ m pc}$ | och to which the | Tables refer, | the end of the | 1939th year o | f the |
| Æra of Sali | vihana, | ****** | ******* | 4+>**** | 4.7.4411 | 171 |
| Ratio of the S | un's Zodiacal r | evolutions to me | an Lunations,- | -For the Prate | hama or Padh | yam i |
| Tidhi, | ******** | ******* | ******* | ***** | ****** | 172 |
| Time of new ? | Moon, -Mean | Zodlacal revolu | tions of the A | Ioon, | | 173 |
| The Moon's m | ean place in th | e Zediac at the l | peginning of th | ie year,—Mean | periods of Y | ogas, |
| -End of the | ie Yega, | ******* | ****** | ******* | ***** | 171 |
| Number of A | nomalistic revo | lutions of the M | loon,—The M | loon's mean. A | noma'; Inl. | ex of |
| the Tidl.i Ta | able (XXVIII) |), | ****** | ******* | ****** | 173 |
| Number of A | nomalistic rev | elutions of the S | Sun,—The Sur | a's mean Anom | aly at the tin | e of |
| new Moon,- | -Index of the | Solar Table XL | I,Index of | the Nacshatra' | Table XXXII | X, 176 |
| Sclar Table X | LI answers to a | on Anemalistie re | evolution of th | e Sun,—For th | ie true time of | new |
| Moon,- Fo | r the true time | of the end of the | e Nacshatra, | 20021116 | ******* | 173 |
| Fer the true ti | me of the end | of the Yoga,—F | or the Carna | at the beginning | g of the year, | 179 |
| For the mean t | ime of the beg | inning of the 2d | Tidhi, | ,,,,, | ** **** | 139 |
| The Thyajum | of Wurjum, | 587.0T049 | 49788358 | 41791948 | 60774480 | 131 |
| | | PA | RT II. | | | |
| Method for co | omputing the n | nean and true pl | aces of the Pl | anets in the Zo | diac, by mean | as of |
| | • | the Astro | nomical Table | s . | , • | |
| Epoch of the la | st day of the 4 | 308th year of th | e Cali yug, | Mean places of | the Planets or | ı the |
| | | the Druva,_A | | | ******* | 132 |
| Of the Nedes, | _The Ayana | nsa,-The Sun's | s mean Eleme | nts, Table XX | Miean mo: | Lon, |
| | | dniel.t at Lanca, | | ******* | | 133 |
| Place of the Su | n's Apogee,—'l | l'rue or apparent | Elements,N | Iean Elements o | of the Moon, T | able |
| | ex,—Moon's n | | 11141111 | | 4,,,,,,, | 184 |
| Moon's true p'. | ace,Moon's | Lativalle,—The | Planets,-Mai | rs, Table XLI, | —His mean p | lace |
| | | ,—IIis Aphelion | | ******* | | 135 |
| | , | e,—His apparent | | | diurnal motion | |
| | | Mercury, Table | | | | |
| Lanca, | ,,,,, | | ****** | mem process | 134144 | 187 |

| (| Page. |
|--|-------------|
| His Aphelion and Node,-His true Heliocentric place,-His true Geocentric place,- | |
| diurnal metion, | 188 |
| His mean and true Latitude, -Note: The apparent place of Jupitar and Saturn, are e | |
| puted in the same manner, mutatis mutandis, with that of the Flanet Mars; and the appa | |
| place of Venus is computed like that of Mercury, Jupiter's Table (XIAII), Its In. | |
| His mean Heliocentric place, | 133 |
| Ris Aphelion, His Node, Venus' Table (XLIV), His Index, Blean place at Lance | |
| Her Aphelion,—Her Node;—Saturn's Table (XLY),—Its Lidex,—His mean place | e at |
| midnight at Lanca,—His Aphelion,—His Node, | 190 |
| PART III, (a Fragment), | |
| Method of computing the Declination, Ascension, Ampiltade, &c. of the Planets. | |
| The Moon, Mars, Mercury, The Moon's Ascensional difference, | 191 |
| General Problem,—For the mean places of the Planets by the Sastra rules, | 11.2 |
| For the Sun and Moon's Apogee, and Aphelion of the Planets,-For the place of their Node | s, .193 |
| Afficial formation of the second of the seco | |
| | |
| THIRD MEMOIR. | |
| On the Indian Cycle of 60 years, or Vrihaspati Chacra: the Cycle of Jupiter. | |
| Advertisement, | 197 |
| Three Rules or Styles for the Cycle of 60 years in use in various parts of India, | 193 |
| According to the Surriah Siddhanta,-Exemple, | 200 |
| Date of beginning relatively to the commencement of the Hindu Solar year,-To the Eu | 110- |
| pean Kalendar,—The same by Table XI, | 201 |
| Resolution of the last expired year of the Cycle according to the Jyautistava, Rule | and |
| Example,—The same by Table XIV, | 20 2 |
| Illustration, -Ushepa, -Epoch of Vrihaspati referred to the Era of Salivahana, | . 203 |
| Resolution of the last expired year of the Cycle according to the Tellinga Astronomers | ·, |
| Rule and Example,—Comparison of the three results, | 201 |
| Of the Cshaya or expunsed year according to the Surriah Siddhanta with the correc | tion |
| of the Tika, | . 206 |
| Period of the Cshaya, | 207 |
| Of the same according to the Rule of the Juntislava, Of the occasion of the Cshaya | b y |
| this process, and use of Table XIV, | 203 |
| For the periods of the Cshaya, | 203 |
| Concurrence of the Siddhanta and Jyautistava Chacra years, | 211 |
| Concurrence of the Sildhanta and Tellings Charge were Concurred of the United | |

month Chadrapada, of the Luni-solar year 3724 of the Cali yug,

The last Tidni of the Luni-solar month Sravana fells on the 24th of the Solar month Audi,

| and Wednesda | y the 14th J uly | A. D. 622, an | d therefore th | e Prathama ' | Tidhi of the Lu | <i>Pagei</i> nar |
|---|--|--|--|---|---|---------------------|
| month Bhadra | pada on the 25 | h Audi, and T | hursday the | lötli July of | the said Christ | ian' |
| year, | ****** | ****** | ****** | • | ****** | 232 |
| | | ron | TE II. | | | |
| On Dr. Hatton's | rule for finding | the year of the | Hejira, | ****** | ******* | 2 33 |
| Postscrift, | LP+#194 # | 40/14/19 | ••• | ***** | \$1707346 | 231 |
| | | the state of the s | | | | |
| | | | VDICES. | | | |
| APPENDIX IC | On the manner | of computing t | he Ahargana | for the beg | inning of the Sc | lar |
| years, and end | l of the Luni-sc | lar years, coun | ited foom the c | commenceme | nt of the Call y | uz. |
| • . | | - | | | na for either, n | • |
| easily be dedu | | | ****** | ****** | ******* | 239 |
| Account of Tabl | , | ******* | ****** | | £1001418 | ib. |
| Account of Table | e XLIX, | 4144444 | a#1\$1-P\$ | ****** | 8674424 | 211 |
| Epochs of Interc | • | ed by the said I | ables. | £>>******* | | ib. |
| Cali yug; fre apparent place also for referri corresponding | na the birth of A in the Hindu S ing the Epochs of Hindu Solar da | Salivahana; or sydereal Zodiac of ancient phæn | of the Cycle at the time of comena, record | of 60 years the common ded in Europ | ne beginning of the Surfaced event; a bean time, to the | a's .cd |
| The Ayanansa, t | | | • | ******** | ******* | 246 |
| The same defined Its Phases, | according to in | e nonons of me | aera maga A | stronomers, | 40P35188 | 217 |
| The Problem und | der consideration | | he the ments | of 1 77 | ******* | ib. |
| The Mircu Trop | Ical Longitude | of any point in | the Fell sta | or several E | xamples, | 218 |
| Hinda Sydere | al Ecliptic,—Ti | ne same reduced | to its position | n in the $E_{m{u}}$ | nus position in t repean Ecliptic, | he — |
| | of the Propositi | , | | ****** | ******* | 249 |
| Notation, Formu | læ, and Examp | le3, | 24543 | 6+8=++4M | 400000.7 | 251 |
| Proposition I, | ******* | #0794220 | ****** | | ******* | 252 |
| Prepositions II, | III, and IV, | | 46181314 | E++9++++ | ***** | 253 |
| Proposition V, | ******* | ******* ** | \$5\$488 4 07.00 | .,,,, | ******** | 254 |
| Examples, | **** | **** | 41581441 | ***** | from 254 t | o 2 70 |
| First Case, where | o the vestiges of | an old inscripti | ion are expour | ided, | ****** | 270 |
| Second Case: Ti | ie date of an an | cient Solar. Eclip | pse expounded | into Minda | Solar time | . 276 |
| How to express tl | le Sun's Sydere | d Longitude, ac | cording to Hu | ida a zcount. | in remote times | 980 |

| | CONTEN | T S, | | xxvii |
|--|--|-------------------|---------------------|--------------|
| Conclusion, where | | v118466 | • | Page. 280 |
| Case where the Sun's apparent Lon | eitude is found rec | | intion | 200 |
| Postscript: Calculation of the pi | - | | • | _ |
| Tropical one, at the end of each | _ | • | tun mann | ib. |
| Appendix III, | ************************************** | 4114444 | ******** | 291 |
| A sketch of some of the principal Z | ras and Periods of a | | rred to in Chrono's | |
| with directions for finding the c | | - | | · |
| according to the Hindu styles of | | | | 293 |
| A Chronological Table of the pri | = | | | |
| . mencing; according to Dyonish | | noser- | Expose4 | 303 |
| Examples I, II and III, | ******* | | ****** | 303 |
| Of Eras subject to Cycles, | and a sair b | **** | ****** | ib. |
| Note, | ****** | 91201179 | \$47.447.4 9 | 304 |
| APPENDIX IV, | 23047244 | 99929419 | 4 | 305 |
| Some account of the Hindu Epheme | erides, | ******* | ****** | 30 7 |
| Of the Ravi Panchangum (Solar | • | ****** | 411**** | ib. |
| Account of the Crantum, Of the | | | ***** | 308 |
| Of the Latta, | · | | ****** | 309 |
| Anniversaries generally observed, | ****** | 4174444 | 42201040 | 310 |
| A Table shewing the names of th | | triarchs, who pr | eside over the Cal | pa; |
| with the Lunar days or Tidhis o | | • | | 311 |
| A translation of the first page of the | | | | Cali |
| yug, with Ephemerides, computer | | | | 313 |
| The same of the Luni-solar concu | irring year, compi | ated with the El | ements of the Suri | iah |
| Siddhanta, | 85494410 | 34,714117 | ****** | 318 |
| | | - | | |
| | TD 101131 | ara | | |
| | FRAGMEN | | | _ |
| FRAGMENT I. On the Formulæ o | | calculating the E | clipses, the Tables | |
| Sines and divers other Astronom | • | ******** | ******* | 325 |
| FRAGMENT II. On certain Infinite | | n different parts | ot India, by varie | |
| Gentlemen, from Native Astrono | - | ******* | ******* | 330 |
| FRAGMENT III. On the Tamul di | • | 99184888 | 918117-7 | 332 |
| ••• | n Eclipse of the Mo | oon by means of | certain memorial, a | |
| _ | | | | A A 3 |
| Fanament IV. Computation of an artificial words, and of shells, in | lieu-of figures, | 89197813 811 | 201010 | 354 |
| _ | lieu-of figures, | #9679#613 #FF | essbegeg. Bulles | 324 |

INDIAN CHRONOLOGICAL TABLES,

With directions for using them, p. i of a new series, inserted after 343

OF THE TABLES.

| TABLE. | r finding the Soot | a dina. or init | ial feria. and | Sydereal hegian | ing of ary So | le r |
|--------|----------------------|------------------|----------------|--------------------|------------------|-------------|
| | r, according to th | • | • | • | | |
| • | r finding the same | | | | 90 years, call | |
| | ahaparivrithi, as | | | | | |
| | hibiting the Hind | | = | | | |
| | ration ; their Root | | | | | |
| | r converting Eur | | _ | | | |
| | suddias and paras | | | meronas, me | | , 5 |
| _ | r finding the Don | • | , | | inta + Parta fir | _ |
| | d second | | onsini, and c | a centile accou | into, Latto ni | ა: 6 |
| | Part 3d | | | ******* | •••• | 7 |
| | or finding the feria | or weekly da | c which begins | any proposed v | ear | 8 |
| | ewing the Epoch- | | | - | | |
| _ | om A. D. 0 to 200 | | | , corresponding | to secular yea | a. 1 5 9 |
| | or years ascending | | of Christ from | n O to 100 P: | art first | . 10 |
| | Part second | ****** | | ,,,,, | | . 13 |
| | chibiting the Domi | | | | | 12 |
| | ewing some of the | | • • | • | | |
| | ith reference to the | | | • •••••• | | , 13 |
| _ | to the Julian styl | • | , | a1007848 | | 14 |
| Tabl | les for computing t | he rank, name | and beginning | of the years of th | ne Cycle of 60 | - |
| | rihaspati, compute | | | | | |
| | al year, according | | | | - | |
| XIJ: | ipiter's mean helio | centric motion | for Solar year | rs uncorrected | according to | ; |
| | urriah Siddhanta, | | * | | according to | ib. |
| | unual Increment, | | | | ude, according | |
| | ie Tika, at the rate | | | | • | ib. |
| | For converting Ju | | | | | |
| | ydereal time, | 95748600 | 4.201169 | •••••• | total pe | 71a. 16 |
| XIVF | For converting the | fraction of the | first term of | the Jyautistava | Rule, into Sa | |
| | me, the Saura yea | | | .,, | ******** | ib. |
| | | | • | • | | |

| | | | • | 1 |) | | |
|----|---|---|---|---|---|---|---|
| ,C | 0 | N | T | E | N | T | ç |

| | • | ,,c | ONTEN | T S. | • | ж | (XiX |
|--------|-----------------|-----------------------|-------------------|---|---------------------|---|------|
| TABLE. | .For convertin | g the Sun's m | otion expressed | in degrees, i | into <i>Saura</i> t | pime, and vi | age. |
| | versa, | ****** | 4.050000 | ****** | •• | ••••• | 17 |
| XVI | For convertin | g.Saura time | of one day to a | degree, to me | ean Solar Syd | ereal time,. | 18 |
| XVII | Exhibiting the | e progress of J | upiter in degre | es, &c. for S | olar years of | 365° 15d 31 | 12 |
| | 31c correspon | ding to <i>Vrihus</i> | pati years of 3 | 61 0 2d 4 p 44c | ,2329 as ded | uced from th | be. |
| | precepts of th | e Surriah Sia | dhanta and Ti | ka, | | | 19 |
| XVIII | Exhibiting th | e Epochs of | expunged year | s of the Cyc | le of 60 yea | ırs, from tl | he |
| | beginning of | the Cali yag to | A. 5128, in m | ean Solar Syc | lereal time, | ****** | 20 |
| XIX | Exhibiting the | Epochs of th | e expunged ye | ars of the Cyc | cle of 60 yea | rs, agrecab! | !y |
| | | | d with those of | | | | |
| | of Salivahane | ı, | **** | 41 | r&1819 | 4-1-1-1- | 23 |
| | | Solar | and Lunar | Tubles. | | | |
| XX | .Of the Sun's | mean motion f | or days | ****** | 4,000 | | 24 |
| XXI | Of the mean | motion of the | Moon, of her A | Apogee, (with | Bijah) and | Node | . 25 |
| XXII | .Of the Sun's | Auomalistic E | quation, accord | ling to Vavila | la Cuchinna | , | 23 |
| XXIII | Of the Moon' | s Anomalistic | Equation, acco | ording to the s | ame authorit | y, | ib. |
| XXIV | Of the Solar I | Equation, by | Maracanda, | 4>+>+ | *** | | 29 |
| XXV | .Of the Lunar | Equation, by | the same, | 11001071 | | • | 30 |
| XXVI | Of the Moon' | s Anomalistic | Equation and a | pparent moti | on, being the | e first of th | ıe |
| | Vakiam proce | | 9.007.044 | ****** | 4444 | **** | 31 |
| XXVII | .Of Equation | of the Sun's S | aura to his app | oarent motion, | called Fogh | iadi Table; | |
| | b. ing the seco | nd of the Fak | iam process, P | art 1st | 4111144 | ****** | 33 |
| P | art 2d | ****** | . ******* | ****** | | | 34 |
| XXVIII | .Of the Sun's | true motion fo | or 366 days, bel | ing the 3d of | the Vakiam | process, | 36 |
| N | N. B.—For the | 4th of the sa | me process, see | Table XLV | II. | | |
| XXIX | For finding th | ne Epochs of 1 | nean Intercalat | ions of Luni- | solar years | and months | i, |
| | from the year | 0 of the Cali | yug to any oth | ier time, | ******* | ****** | 38 |
| XXX | .Trigonometric | al Tables, wit | h demonstration | is of some cas | ses of Plane a | ınd Spherica | ıl |
| | | | the Hindu doc | , | | ****** | 38 |
| T | ables for facil | litating the re | solution of A | stronomical a | nd Gnomon | ic Problem | s, |
| | according to t | he theories de | livered in the se | econd Memoir | , | ***11 | 43 |
| XXXI | For converting | g parts of the | Equator into I | ndian time, a | nd vice versa | , | ib. |
| XXXII | .Shewing the S | un's Declinati | on, Right Asce | ension, and A | mplitude who | en his Longi | i |
| | tude is I, II, | and III Sign: | s; which quant | iti es ar e cons | ant, and app | olicable to a | 11 |
| | places, | 2771113 | 8*7*17*8 | 411111111111111111111111111111111111111 | *** | 11119 | ib. |

| TABLE. | Exhibiting the Latitudes and I | ongitudes of certai | n principal pla | ces in India re | Page |
|-----------------|-----------------------------------|--|-------------------|-----------------|--------------|
| 71 28 1 1 1 1 1 | red to the Meridian of Lanca, | | | | |
| VIVYX | Exhibiting the Palabah, or Vi | | | | |
| PE'ETE A III | on the days of the Equinoxes, | • | | • | |
| | called Seva-desa Paridhi; at | | | _ | |
| XXXV | Shewing the Ayanansa (the a | | | * | 45 dian |
| | Sydereal Zodiac, and the Ver | | | | |
| | Solar Sydereal years, concurri | | | | |
| | *** | and the cuttors | an december year | 3 Hom 71, D. | 46 |
| | • | | | 4 4 17 | |
| XXXVI | The same; being in the ratio | of 54" 11 15" to | the Ayanans | a given in T | able |
| | XXXV, and being auxiliary | to it, for Endling the | error of the | Sun's mean Lo | ng i- |
| | tude as computed in the Hin | du Solar Tables, | when referred | to the Europ | pr an |
| | Tables, | pd 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | ****** | 9000 1106 | 47 |
| XXXVII | Tidhi Table, referring to the | Appendix to the 2d | Momoir, | ***** | 4.3 |
| XXXVII | I. Nacshatra Table, referring to | the same, | ******** | **** ***, | ib. |
| XXXIX. | Yoga Table, referring to the | same, | 44>4 (24+ | ******* | 49 |
| XL | Solar Table, adapted to the 3 | 71 mean Tidhis, co | rresponding to | the mean dura | tion |
| | of the Solar year, giving the Sun | e's Equation and Sci | ni-diurnal Arc | s; referred to | do. 50 |
| XLI | Tables of the Planet Mars, | , sece ste# | ***** | **** **** | 52 |
| | 1. His mean motion for days, | £43624 00 | ****** | ****** | ib. |
| | II. His Anomalistic Equation | , | . ***** | ****** | • 53 |
| | III. His Annual Equation and | d true distance from | the Earth, | #1-01949 | ib. |
| X LII | Tables of the Planet Mercury | , | 4 | ******* | 54 |
| | I. His mean motion for days, | 4.941010 | #1+444** 1 | ****** | ib, |
| | II. His Anomalistic Equation | 9 8040-510 | 8064.00.0 | | 55 |
| | III. His Annual Equation and | l true distance from | the Earth, | 9914444 | ib. |
| XLIII | Tables of the Planet Jupiter, | ****** | £1171116 | ••••• | 56 |
| | I. His mean motion for days, | 90301111 | 500.0000 | ****** | ib. |
| | II. His Anomalistic Equation | , | ******* | ****** | 57 |
| | III, His Annual Equation and | l true distance from | the Earth, | speeds. | ib. |
| XLIV | Tables of the Planet Venus, | \$ctu | 9+++++> | ******* | 58 |
| | I. Her mean motion for days, | 4004550B | **** | 4107 1007 | ib. |
| | II. Her Anomalistic Equation | 9 " 4004 *100 | 5566 5156 | ****** | 59 |
| | III. Her Annual Equation an | d true distance from | the Earth, | ****** | ib, |
| XLV | Tables of the Planet Saturn, | p++9+>40 | , | 41725747 | 60 |

| | CONT | ENTS. | | | xxxi |
|-----------------|---------------------------------------|--------------------|-----------------|-------------------------|------------|
| TABLE. | I. His mean motion for days, | • • | ****** | • | Puge. |
| | II. His Anomalistic Equation, | | | ******* | 61 |
| | III. His Annual Equation and true | dictance from | the Forth | ******* | |
| YIVI | Shewing the Lagna, Chara-Cumda | | | notion not the Pette | ib. |
| A&3.4 7 1 .,,,, | calculated for the Latitude of 16° | | | _ | |
| | referring to the Appendix to the 2d | | t or Banta, n | car musumpu | 62 |
| VIVII | | - | | | |
| ALITIN, | For reducing the Moon's place, as | | | | |
| | to what it is at the same instant as | | | | |
| | Tanjore; being the 4th of the Va | | - | | , |
| | but which should have been XXII | X, called by the | e Tamuls Dese | ntara Table, | ib. |
| XLVIII. | | apsed from the | commencemen | t of the Caliy | us, |
| | to any given Epoch. 1st Part, acco | ording to the Si | urriah Siddhan | ta, | 63 |
| | 2d Part, according to the Aria Siddha | nta, | ****** | 1,,,,,,, | ib. |
| XHX | For the Luni-solar Ahargana, from | a the commen | cement of the | Cali yug, to | any |
| | given Epoch. 1st Part, according | | | 1-11-11-1 | 64 |
| | 2d Part, according to the Aria Siddha | ınta, | ****** | ******* | ib. |
| L | For the Root or Character of every | month in the | Mahommedan y | ear, according | g as |
| | that of Mahorum is 1, 2, 3, 4, 5, | | *7****** | ******* | 6 7 |
| L1 | Exhibiting the respective beginning | s of the Hejir | a, and Hindu S | Solar, concuri | rent |
| | with European Secular years, | * ******* | ******** | ****** | 68 |
| LII | Part I.—Shewing the Sun's mean | | | v of each Sec | |
| ************* | year of the Julian Kalendar from | | | | |
| | | | | | |
| | means of Delalande's Solar Tables I | • | ioon time unuer | the Munital | |
| | Paris; with Examples of its applic | | **** | | 69 |
| | Part II.—Shewing the Sun's mean mo | | | | |
| | constructed by means of Delalande | 's Solar Table. | s III and IV; | with Examp | oles |
| | of its application | ***** | B0554848 | ******* | 70 |



• 1 • . • .)

FIRST MEMOIR.

A KEY TO THE MADHYAMA SAURA MANA

OR

MEAN SOLAR SYDEREAL YEAR,

USED BY THE

TAMUL INHABITANTS OF THE PENINSULA OF INDIA.

Written in the year 1814; Revised and augmented in 1824.



A

KEY TO THE MADHYAMA SAURA MANA.

PART I.

General account of the Solar Sydereal and Civil years, as used by the Tamul inhabitants of the Peninsula of India.

In most of the tracts that have hitherto been published on Hindu Astronomy, or Chronology, it has been assumed that the reader was sufficiently well acquainted with the elements of these sciences not to require a second initiation; a very mistaken idea, whether it be propagated in Europe or in India, and which, for obvious reasons, I shall not adopt on entering into the subject of this Memoir. How to open the elementary part of it without alarming the reader by a long series of definitions expressed in a dead oriental language, or how to reduce the preliminary notions which these definitions are meant to convey, to a convenient scope, without risking to become unintelligible, is an alternative which leaves only a choice of difficulties. On mature consideration, however, I have thought it adviseable to follow a middle course, and shall consequently present definitions to his attention only as they become necessary in the progress of these Memoirs, unless they be of a nature very general, and easily understood. What my expositions may lose by such an option from want of scientific arrangement will, I hope, be balanced by the advantage of this research being introduced under a less discouraging aspect.

This first Memoir contains very little theory. The construction of the Solar year, such as it is generally used in that part of India which lies South of the river Nărmădi (believed to be the same as the Nerbudda), is extremely simple when compared to that of the Luni-solar year. The perusal of it, therefore, requires little or no mathematical knowledge; but it forms, nevertheless, an indispensable introduction to the latter; and in order to render this part as efficient for that purpose as possible, a great portion of the following pages will be occupied by the exposition of certain mechanical rules, whereby the various circumstances of the common Hindu Solar year, may be easily discovered. The time consumed in becoming acquainted with these, will be recovered with profit, when in the second Memoir, we come to treat of the Astronomical year of the Hindus, the whole construction of which rests on principles so different from those of European Astronomy, that all elementary notions of that science must be laid aside for a time by the reader, if he be desirous to avoid the inconveniences which must necessarily result from premature conclusions.

(4) SECTION I.

Of the division of Time into years, seasons, months, days, and fractions of the same; principally according to the Tamul Kalendar.

ARTICLE 1.

The Tamul Solar year (as it is improperly called in the Carnatic) is Sydereal, it contains that space of time during which the Sun departing from a Star, returns to the same.

Beginning of the Solar year referred to the hegoring of the Lunar Zodiac by the ancicuts, and to that of the Solar Zodiac by the

modeips.

Ancient Astronomers (by which distinction I mean those who rejected all computations made in Solar time) accounted it to begin when the Sun enters the Lunar mansion Aswini, the first of the twenty seven regular Nacshatras contained in the fixed Lunar Zodiac (*). But modern Astronomers, who regulate the year by the Sun's revolutions without any reference to those of the Moon, account the year to begin, when that luminary enters the Sign Mesha (the Indian Aries) of the fixed Solar Hindu Ecliptic.

Civil and Sydereal account.

Each Solar month contains as many days and parts of days as the Sun stays in each Sign. The Civil differs from the Astronomical account only from its rejecting fractions of days, each year and month being accounted to begin at Sun-rise, instead of the time of his mean entrance into the respective Signs; observing that if the said fraction exceeds 30 Indian hours (24 European minutes to a danda or guddia being the term for an Indian hour) which lapse of time is conceived to be the mean half of the day, then the Civil year, or month, are accounted to begin one day later than the Astronomical ones; whereas if the time falls below that quantity, both coincide.

The seasons.

The Hindus divide the Solar year into six seasons (called Ritu in Sanscrit) of two months each, the succession of which is always the same, but whose vicissitudes as to climate, depend on the place of the Sun's Apogee in the fixed Zodiac, and the position of the Equinoctial Colures relatively to the beginning of the Sydereal Zodiac. Their order and names, under all possible circumstances, as well as that of the months which they comprehend, are according to the Hindu and Tamul denomination as follows. (†)

HINDU.

| 1 Vasanta. | 2 Grishma. | 3 Varsha. | 4 Sarada. | 5 Hemanta. | 6 Sisira. |
|------------|-------------|-----------|-------------|--------------|-------------|
| Chaitra X | Jyaisht'a & | Sravana 5 | Aswina my | Margasiras m | Magha 1 |
| Vaisacha Y | Ashar II | Bhadra 2 | Cartiga 🗻 | Paushia v? | Phalguna == |
| | | TA | MUL. | | |
| Poongoni * | Vyassei 8 | Audi 55 | Paratusi my | Cartiga m | Tye # |
| Chaitram Y | Auni II | Auvani 2 | Arpesi ≏ | Margali V? | Maussi 🗯 |

(*) The Solar and Lunar moveable Zodiacs are called Trapical; and their position, relatively to the Sydereal pack, depends on the precessional variation; called Cranti Polyagati in Sanscrit.

ones, depends on the precessional variation: called Cranti Pala-gati in Sanscrit.

(†) It will seem extraordinary that the Tamul Astronomers should have adopted a different distribution of the months of their Solar year when referred to the seasons, from that of the other Hindus. Such, however, is the case, for according to them, the months and seasons are arranged as follows:

| l Vasanta. | 2 Grishma. | 3 Varsha. | 4 Sarada. | 5 Hemanta, | 6 Sistra. | |
|-------------------------|--------------------|-------------------------|-----------------------|------------|--------------------------|--|
| Chaitram Υ Vyassei ⋈ | Auni [] Audi 95 | Auvani S Paratasi mp | Arpesi ≏ Cartiga M | Margali V9 | Maussi ## Poongoni ** | |

. .

which advances the Tamit seasons by one month throughout the year.

The names of the twelve Signs of the Zudisc are

| 1 | Y Mesha, | 2 | & Vrisha, | 3 | II Midhuna, |
|----|------------|----|--------------|----|-------------|
| 4 | ⊕ Carcata, | 5 | & Sinha, | 6 | my Canya, |
| 7 | ≏ Tula, | 8 | m Vrischica, | 9 | 1 Dhanus, |
| 10 | vy Macara. | 11 | zz Cumbh'a, | 12 | € Min. |

The signs of the Zediac.

The twelve Signs together are called the Rasi Chacca, or Circle of the Signs. The Ecliptic Names of the Eclip-Cranti Mandala, and the Equator Nari Mandala. Their respective Poles Druvas.

tic and Equator.

The names of the months used in the Surriah Siddhanta are the same as those of the Signs, adding Masa thereto. Those of the Tamuls are

Of months Sarrial Sidebantu.

| 1 1 | Chaitram, | 2 | Viassei, | 4 | Auni, |
|-----|-----------|----|----------|----|-----------|
| 4 | Audi, | | Auvani, | | Paratasi, |
| 7 | Arpesi, | s | Cartiga, | ρ | Margali, |
| 10 | Tye, | 11 | Maussi, | 12 | Poongoni. |

Tamul mouths.

The names of the same months used more generally by the Hindus are

| j | 1 | Vaisacha, | 2 | Jaish'ta, | 3 | Ashar, |
|---|----|-----------|----|----------------------------|----|----------|
| | 4 | Sravana, | 5 | Bha'dra | 6 | Aswina, |
| | 7 | Cartiga, | 8 | Margasiras or } Agrahayan, | 9 | Paushya, |
| | 10 | Magh, | 11 | Phelguna, | 12 | Chitra. |

Bengal months,

The latter names are used by the Tellingas for their Luni-solar year, with this only difference, that as the common Luni-selar year, colled Chandra Mana, is accounted to begin with the new Moon which precedes the commencement of the Solar year, the Lunar month Chitra begins, and Phalguna ends the year.

The Hindus have a great variety of ways of considering the day, and of fixing its duration. The principal are,

The space of time called day, variously considered.

10 The Savan, or natural day, is the time between two consecutive Sun risings, therefore the Savan days are of various duration, even under the Equator.

According to the autient Sastras, or inspired books, the Savan day is divided into 60 dhatas or ghatica-dan las; the dhata 60 vinadicas, the vinadica 6 pranacalas; the pranacala 10 vipalas.

20 The Saira day is the time during which the Sun describes one degree of the Ecliptic. These days are therefore longer or shorter, as the Sun is near his Apogee or Perigee. They are divided in the same proportions as the Savan days but with different names, viz. Danda, vicala or pala. prenacala, (or respiration) castacala.

Astronomers sometime divide time in minuter parts; thus the vipala, or castacala into 60

alipalas, the alipala into 3600 nimeshas or twinklings of the eye, on account of which this sort of time is denominated Murta, meaning as above.

that formerly mentioned.—It is Sydereal, being the time between the same point of the Ecliptic rising twice; or rather the time between the Equinoctial points (called Ayana) rising twice. These days are accounted to be equal to one another throughout the year and are used by the Tamul Astronomers who compute in Solar time in their preparatory operations; being always equal to 60 guddias, subdivided sexagesimally into viguddias, paras and suras, which denominations are also used in Lunar computations. It is proper, however, to observe here, with a view to avoid future confusion, that the measure of time called guddia means also an arc or portion of a Nacshatra (or Lunar mansion) of 130 20°, which is likewise subdivided into viguddias, paras, &c. having no immediate reference to time.

Names of the subdivisions of the day according to the Tamula.

The fractions of the Solar day used in this Memoir are invariably the last mentioned. The Lunar day or Tidhi will be noticed more conveniently in its proper place.

The names of the days of the week are common to all styles and prevail all over India. They have the same signification as those used in ancient and modern Europe, and are as follows:

Names of the days of the week,

| 1 | 1 | Sunday | Ravi-vara | Sen |
|---|---|-----------|--------------|---------------|
| | 2 | Monday | Soma-vara | Moon |
| | 3 | Tuesday | Mangala.vara | Mars |
| | 4 | Wednesday | Bhuda-vara | Mercury |
| | 5 | Thursday | Guru.vara | Jupiter |
| | 6 | Friday | Sucra-vara | Venu s |
| | 7 | Saturday | Sani-vara | Saturn. |

Time of the Sun moving through the Northern and Southern signs, The unequal portion of time assigned to each month, dependant on the situation of the Sun's Apsis, and the distance of the Vernal Equinox (called Mesha Ayana) from the beginning of the sign Mesha, is also affected by the difference of time which the Tamul Astronomers assign to the Sun for moving through the Northern and Southern signs of the Ecliptic, the time for the former being 186 days, 21^h 38m 24s, and for the latter 178 days, 8h 34m 6s. The odd hours and minutes of which they apply to the beginning of the year and months; and being so distributed they do not require the assistance of Leap, or Bissextile years, because they reckon the Astronomical beginning of each, from the hour and minute over 365 days when the last year and month expired.

The Civil Solar year of 365 and 366 days.

The Civil year, however, is of 365 and 366 days, like that of the Europeans, the latter being determined by the rejection of fractions, as was already hinted at page 4, and not by any regular intercalation. It results from this arrangement that Civil time is sometime longer, sometime

shorter than the Astronomical. Thus according to the Tamul computations the month of Auni of the year of the Cali yug 4847 (June 1745) commenced on Thursday at 44sud. 50viz. after mean Sun rise, which exceeding 30 guddias shews that it begun 14z. 50viz. after Sun set, and so by the Civil reckoning the first of Auni fell on Friday the 11th, instead of Thursday the 10th of June; and as it ended on Monday the 12th of July, it follows that the Sydereal month of Auni was of 32 days, and the Civil only 31. In the same manner, as the following month Audi, began on Monday the 12th July at 21z. 28v. 18p. (below 30 guddias) and ended on Thursday the 12th August at 49sud 40v. 20p. (above 30z.) it follows that the Civil month was of 32 days, and the Sydereal only 31.

From these preliminaries we shall be enabled to discover by means of the fraction of the root or initial feria of the month Chaitram and Solar year (called Soota dina) whether it be one of 365, or 365 days according to Civil account, but we must previously show how the Tamuls compute the beginning of their years and months.

In order not to crowd unnecessarily the matter on the reader's attention, I shall assume for the present that he knows that the Hindus have imagined, among several others, four grand periods which collectively taken form one of 4320000 years, called a Mahayug or great period of conjunction of the Planets in the beginning of the Hindu Zodiac—that these are called the Saiyayug, the Tretayug, the Devapar yug and the Caliyug; the latter of which (that in which we live) consists of 432000 years, and that of these years 4025 had expired in A. D. 1824—the current one being the 4926th (of the Caliyug). We need therefore carry our present speculations no higher than the beginning of that era, as the Tamul Astronomers are contented to do when they compute their Solar Kalendar.

ARTICLE 2.

Rule for finding the mean epoch of the commencement of the Tamul Solar year.

The Tamul Astronomers have adopted the Solar year of the Aria Siddhanta, the duration of which is 365d 15g 31v 15p, in preference to that of the Surriah Siddhanta which is 365d 15g 31v 31p 24s (*), and as they generally work in Solar time, they use it also in their Lunar computations: but this is to be understood only of the Northern Tamuls, called *Vachij* by their Southern neighbours, (I suppose on account of their using the *Vakium* process in their operations), for the latter, who stile themselves *Sittandij*, employ another Solar year, of 365d 15g 31v 30p, and make use of a Cycle of 90 years, the construction of which will be explained in a subsequent article.

Duration of the Solar year Vachij 360d, 15g, 31v, 15p,

Sittandij 365d. 155. 31v. 30p.

Rule for finding the Ahargana or time elapsed from the beginning of the Cali yug to that of any proposed year.

Rule for finding the Ahargana.

"Write the numeral of the proposed year in two places; multiply the first by 365½ and the second by 5. Subtract 1237 from the product of the latter, divide the remainder by 576, the quotient will give days. Multiply the second remainder by 60 and divide again the product by 576, the quotient will give guddias, and so forth to viguddias and paras.—Add the days, guddias, &c. thus found, to the product of the numeral into 365½, so shall the sum be the Ahargana sought, i. e. the time expired on the day computed for, since the origin of the Cali yug."

For the Soota dina or initial feria of the year, "divide the sum of days above found by 7, the quotient will give the number of weeks expired, which neglect; and the remainder will be the odd day, over complete weeks, which counted from Friday (the day on which the week was supposed to end) will give the initial feria of the year sought."

N. B.—If after dividing the second term of the rule by 576, down to paras, there is no remainder, it is a proof that the operation was well performed.

EXAMPLE.

Let the year of the Cali yug 4847 current or 4845 complete, be proposed, wanted its Scota dina and time of the day on which it began.

| 19 4846 365‡ | | 20 4846 × 5 | | Coi Multiply | ntinued. 60 60 |
|-----------------------------|--|-------------------|-------------------|---------------------------------------|----------------------|
| 24230 29076 | | 24230 1±37 | | • | 3600 576 |
| 14538 1768790 1211 30 | Div. by ÷ | 22993 576 | | Quotient With a remainder of Mult. by | 6 viguddias. |
| 1770001 30 | Quotient With a remainder of Mult. | of 529 | days. | Dir. by | 8640 576 |
| | Divide by | 31740 576 | | Without a tems | 15 paras. |
| | Quotient With a rem | | guddias. of 60 | | |
| Product of No. of No. | | 1 30 | v. p. 6 15 | | |
| Ahargana or Tir | ne expired 177004 | 1 25 | 6 15 | | |

7)1770041 252863 weeks.

Remainder O. which counted from Friday, leaves Friday

ANSWER.

The year of the Cali yug 4847 began on a Friday at 255 6v 15p after Sun ise, and as the guddias do not exceed 30, the Sydereal and Civil years begin on the same day.

Father Beschi, from whom I have borrowed this Rule, is silent on the Meridian to which it refers; it is therefore necessary to supply that omission.

The Hindus refer to two principal Meridians—those of Lanca, and of Ramissuram, more properly Ram-Ishura.

Lanca is an imaginary place supposed to lie under the Equator, somewhat S. W. of the Island of Ceylon; it is one of the four cities (Yavacoti being the first, Lanca the second, Bornacoti the third, and Siddhapuri the fourth) which are supposed to lie under the Equator at 90 degrees distance from each other.

The Indian principal Meridians: Lanca, Ramissuram.

The Meridian of Lanca is supposed to pass through two other towns on the Continent of India, namely, Sannihita-suras, and Avanti, the latter, according to common opinion, being Ujjayini, now called Oogein, which lies in 23° 11′ 30″ North Latitude.

The Tamul Rule refers to the Meridian of Lanca a place under the Equator,

That Meridian (in Sungscrete Rec'ha) is supposed to lie 750 53' 15" (5h 3m 33s) East of Greenwich; and 730 33' o" (4h 54m 12s) East of Paris (*), and to this the preceding Rule refers.

Ramissuram is a small Island, situated between Ceylon and the Continent of India, at the entrance of Palk's passage in the Streights of Manaar, and is famous for its ancient Pageda and Observatory.

It lies in 790 22' 5" (5h 17m 28s 20") Long. E. of Greenwich, and 770 1' 50" (5h 8m 7s 30") East of Paris.

Its Latitude is 90 18' 7" North.

N. B.—This position was extracted from Colonel Lambton's Trigonometrical Survey. (+)

Demonstration of the Tamul Rule for finding the Ahargana, and initial feria of the year, called Soota dina.

The first part of this operation, which goes to multiply the numeral of the proposed year of the Cali yug by $365\frac{1}{4}$, requires no demonstration; that multiplier including the 15 odd guddias (6 hours) over the number of entire days contained in the year, which, as was before stated, consists of $365\frac{1}{4}$ 155 31v 15p ($365\frac{1}{4}$ 6h 12m 30s Eur. time). But we are to account for the remaining 31v. 15p. (12^{10} 30s Eur. time) by which the years of the Cali yug expired ought also to be multiplied.

Demonstration of the Rule.

Now, adverting to the process as disclosed at page 8, for the reason that the sum of vears is

^(*) Lanca may be supposed to lie very nearly South of Calicut, the Meridian of the latter place passing only 9d. 4m. 15s. West of the Rec'ha of Lanca.

⁽⁺⁾ The Rules and Tables of Mulli-Carjanada, and Bulla-ditty Callu, refer to the Meridian of Ramissuram.

multiplied by 5, it follows that you are to take only the 1.5th part of 31v 15v or 1875v, that is $\frac{1.575}{1.575}$ v = 375v, or what is the same thing $6\frac{1}{3}$ viguddias.

Now to multiply successively the complete years of the Cali yug 4846 in terms of days, &c. we are to consider that $6\frac{1}{4}$ may be converted into this expression $\frac{3600}{576}$, the numerator expressing the number of minutes in a Tamul hour or guddia; and as the Rule goes to divide the product of the elapsed years multiplied into 5 by 576, we have $4846 \times 5 \times \frac{3600}{576} = 1846 \times 31\frac{1}{4} = \frac{4846}{576} \times \frac{3645}{576} \times 60 \times 60 \times 60$ in which expression the first factor gives the product in days, the second in guddias, the third in viguddias, and the fourth into paras.

We are now to enquire why, having multiplied the years of the Cali yug expired by 5, we have subtracted 1237 from the product.

Observe that, if that number be divided as before by 576 it will give 2d & 51 v 15p, therefore, seeing that according to Hindu account the first year of the Cali yag began on the 4th day of the week at 51s 8v 45p, and that if 1237 be divided by 576 the quotient will give p. c. v. p. as above stated, if we add both 2 8 51 15 4 51 8 15 we have a complete week

so that this equation is merely contrived for the sake of counting the days in the Ahargana from a complete period, i. e. the beginning of the week as it was then considered to be, and this addition will be equally performed, whether you add it to the year, or subtract it from the epoch, in which latter case however, it will be made to begin 2d 8g 51v 15p sooner than it ought, increasing the Ahargana by thus much, which is the cause of the subtractive equation when that element is computed by the Tables.

Having operated agreeably to the preceding Rules, you are to reckon from Friday, because it was then taken to begin the week.

But if you wish to reckon from Sunday, you are to subtract two days from the above account, which will be done if you retrench twice 576, or 1152, and if instead of 1237 you subtract 2389. The latter is the practice of the Southern inhabitants of the Peninsula, called Sittandii.

The Rule and Example given at page 8, as it includes the subtractive quantity 1237, is therefore to be expressed as follows:

$$\frac{4846\times5-1237}{576}\times608 = \frac{20007}{510} = 39 55 6 15$$
and this added to $4846\times365\frac{1}{4}=1770001 30 0 0$
as before found $\frac{1770041 25}{6} = \frac{15}{15}$

and we are to reckon from Friday. But if you wish to reckon from Sunday, it will be $\frac{4816\times5 \cdot 0059}{576} \times 603 = \frac{21811}{570} = 37d$ 55g 6v 15p.

N. B.—It frequently occurs, in the course of research, that it is expedient to compare the Ahargana elicited by the Rule, with that which may be procured by means of the Tables. It is therefore necessary to warn the reader, that although the Ahargana used by the Northern Tamul Astronomers is constructed so as to reckon from Friday, yet if we seek the initial feria of the year, for the same account, by means of Table I. (page 1 of the Tables, we are to count the root of the days inserted between parenthesis, from Sunday, which is not the case when using Table XIVII) page 66, where the remainder after division by 7 is to be told off from Friday.

ARTICLE 3.

On the manner of computing the beginning and duration of the twelve months of the year.

In the present position of the Sun's Apsis (Ravi-Mandocha) which only moves at the rate of 1' in 517 years, and which at the end of the year of the Cali yug 4846 (*) (A. D. 1745) was in 2° 17° 17′ 10″,4 from the first point of the Hindu Zodiac—and of the distance of the said point from the Equinoctial colure (Ayanansa) which increases 54″ in a year, and was at the end of the same year equal to an arc of 18° 41′ 23″ 11″, the separate duration of each of the twelve months of the Solar year (in the aggregate always equal to 365d 15s 31v 15p) was as follows:

| | Bengal. | TAMUL. | | | BENGAL. | TAMUL. | |
|---|---------------------------------------|---------------------------------------|---------------------------------------|----|------------------|------------------|--------------------------|
| | Solar Morths. | Solar Months, | Duration. | | Solar Months. | Solar Months. | Duration. |
| 1 | Vaisacha | Chaitram | d g. v. p. 30 55 3 2 1 | 7 | Cartiga | Arpesi | d. g. v. p. 29 54 7 1 |
| 2 | Jaish'ta | Viassei | 31 24 12 1 | 8 | Margasiras | Cartiga | 29 30 24 2 |
| 3 | Ashar. | Auni | 31 36 38 1 | 9 | Paushya. | Margali | 29 20 53 1 |
| 4 | Sravana | Aadi | 31 28 12 2 | 10 | Magh | Tye | 29 27 16 1 |
| 5 | Bha'dra | Auvani | 31 2 10 1 | 11 | Phalguna | Maussi | 29 48 24 1 |
| G | A swina | Paratasi | 30 27 22 1 | 12 | Chitra | Foongoni | 30 20 21 2 |
| | · · · · · · · · · · · · · · · · · · · | · · · · · · · · · · · · · · · · · · · | · · · · · · · · · · · · · · · · · · · | | | · | <u>'</u> |

Now if it be required to find the Anargana, and initial feria (Soota dina) in the beginning of each Solar month of the current year of the Caliyug 4847, having found the same for the beginning of the year by the general rule given at page 8 or by means of Table I), all that need be done is to add successively thereto the abstract duration of each month, as above exhibited, and dividing as usual by 7, the remainder counted from Friday (or if the Table be used the Roct between parenthesis from Sunday) will give the Soota dina sought.

tion of the months,

How to compute the

beginning and dura-

The following example will answer for all possible cases, when computing in Consequentia. The quantities for each month must of course be subtracted when working in Ante Lentia.

^{(*) 9}th April N. S.

EXAMPLE.

| | Втт | HE I | ULE. | | BY THE TABLES. | | | | |
|--|---------------------|------------------|---------------|---------------|---|------------------|----------------|----------------------|---------------|
| Ahargana for the beginning of A. C. 4847 Abstract dur. of Chaitram | р. 1770011 30 | c. 25 55 | 7. 6 32 | P. 15 1 | Initial Root of A. C. 4847 Table III. | p. (5) (2) | G. 25 55 | v. 6 32 | P. 15 1 |
| Ahargana 1st Viassei of Viassei | 1770072 31 | 20 24 | 38 12 | 16 1 | Monday | (1) (3) | 20 24 | 38 12 | 16 1 |
| Ahargana Ist Auni of Auni | 1770103 31 | 4 1 36 | 50 38 | 17 | Thursday | (4) (3) | 44 36 | 50 38 | 17 |
| Ahargana 1st Audi cf Audi | 1770135 31 | 21 28 | 28 12 | 18 2 | Monda y | (1) (3) | 21 28 | 28 12 | 18 |
| Ahargana 1st Auvani of Auvani | 1770166 31 | 49 2 | 40 10 | 02 | Thursday | (4) (3) | 49 | 40 10 | 2 0 |
| Abargana 1st Paratesi | 1770197 | 51 | 50 | 21 | Sunday | (O) | 51 &: | 50 | 21 |

Here the process by the Table indicates at once Sunday; but if we had worked merely by the Rule for the 1st of Paratasi, it would be 71770197 252885 weeks with a remainder of

which counted from Friday, gives equally Sunday.

ARTICLE 4.

On the Civil years of 365 and 366 days.

Before entering into the manner of expounding the initial feria of the Hindu Solar months for the European concurring date, we shall consider the effects of the operation of the fraction of days annexed to the number of entire days for each month, already hinted at page 4.

Year of 366 Civil days how discover-

The number of registered days contained in any Solar month depends on the value of the fraction of the first Ahargana in the year, which is variable. This fraction combined with those of the remaining months (which abstractedly are constant) determines the character of th year, by which is meant whether the Civil is one of 365, or 366 days: because when the sum, or difference, for any month exceeds 59s 59v 59p, its initial feria passes suddenly from one day to its next.

Thus if the beginning of Chaitram and Solar year be expressed by
the Root
And if you add thereto the collective Roots up to the month Tye v? (Table 111)
You have the Soota dina for Maussi Tuesday, which if expounded in the European Kalendar with the Dominical Letter F, as shall be shewn hereafter, will elicit Tuesday the 12th February Sydereal account.

| But if the same Root be only encreased by | (5) | 5.3 - | ¥. 13 ⊥ | 47 - 1 |
|---|------------|----------|---------------|-----------|
| and you add for Tye as before - | (5) (4) | 53 6 | 13 46 | 48 |
| you have the beginning of Maussi | (3) | U | 0 | O |

on Wednesday the 13th February; and so the month Tye which had before only 29 Kalendar days, would in the latter case count 30, and the following month Poongoni X, which had 30 days before, would now only count 29.

This circumstance, which generally operates so as to exchange the value of two near months, so that their sum remains the same, yet sometimes produces a different result, and determines a Leap or a common year.

Thus let the Root for the beginning of Chaitram and year be - Wednesday (3) 59 59 59

And suppose that being expounded with the Dominical Letter G it brings out the 11th of April, add one para thereto - - - - +1

Thursday (4) 0 0 0

then you have Thursday the 12th April, and the Civil month Chaitram, which in the former case counted only 31 days, will now only count 30, without an equivalent in the next month.

But it will be further shewn that, whenever the Root for Chaitram and year exceeds 44g 28v 44p the proposed year invariably counts 366 days; therefore in the present case, the said year would become a common instead of a Leap year, which it would have been.

When the Root of Chaitram exceeds 41g 28v 44p the year is of 366 days.

Generally the European date concurrent with the beginning of Chaitram and year is an Index which points out whether the Hindu Solar year propounded, consists of 365 or 366 days in the Kalendar, which (to use common language) I shall in future call Common and Bissextile, although the latter do not recur by arbitrary intercalations, as is the case in the European Kalendar.

Root for the beginning of Chaitaan and year expounded into European time—an Index which shews whether the year consists of 365 or 366 days, and indicates the limits of the other 11 menths.

The same date also indicates the limits of the beginnings of the 11 remaining months of the same year, when referred to our Kalendar, in a manner that cannot be mistaken, notwithstanding the great variety of combinations of which the Roots are susceptible.

Rere

10 "Whenever the fractional part of the Root which elicits the beginning of the year falls "below 44g 28v 44p, or up to it, then the year counts only 365 days in the Kalendar."

How to discover a common year.

2º "And when the fraction amounts to 44g 28v 45p then that Civil year counts 366 days."

A Bissextile year.

The demonstration of this precept flows from what has already been said: for c. v. p. let the fraction of the initial feria proposed be Add the fraction of the Root for one year complete 15 31 15

You have for the sum 16 0 0 0

that is, one entire day over and above the sum of days independently of the fractions.

EXAMPLE I.

On the beginning of the year of the Cali yug 4856 (A. D. 1754), the initial Root B. G. v. P. is found to be Tuesday (2) 44 47 30 which if expounded with its Dominical Letter F, will give 9th April N.S.

Now if you add thereto the Root for one complete year (Table I) (1) 15 31 15

You have beginning of Thursday (4) 0 18 45

the year of the Cali yug 4857:

which Thursday being expounded with its proper Dominical Letter E, falls on the 10th April 1755, and shews that the year of the Cali yug 4856 (or Saca 1677) counts 366 days in the Kalendar.

EXAMPLE II.

But if the year of the Cali yug 4882 (A. D. 1781), the proper Root of which is

be proposed, and this Monday be expounded with the proper Dominical Letter

G, it will fall on the 9th April N. S.

Add as before the Root for one year

And you have the beginning of

Tuesday

Having calculated by these Rules the Tamul Leap years of 366 days concurring with the Christian year of the XIXth Century, they were found to fall as follows:

| Number of Leap years. | Christian Years. | Leap Years of the Cali yug con- curring with do. | Years from the birth of Salivaha. na. | Number of Leap years. | Christian Years. | Leap Years of the Cali yug con- curring with do. | Years from the birth of Salivaha- na. |
|---|---|--|--|--|---|--|--|
| 1 2 3 4 5 6 7 8 9 10 11 12 13 | 1801- 2 1805- 6 1809-10 1812-13 1816-17 1820-21 1824-25 1828-29 1832-33 1836-37 1840-41 1843-44 1847-48 | 4903 4907 4911 4914 4918 4922 4926 4930 4934 4938 4942 4945 4949 | 1724 1728 1732 1735 1739 1743 1747 1751 1755 1759 1763 1766 1770 | 14 15 16 17 18 19 20 21 22 23 24 25 26 | 1851-52 1855-56 1859-60 1863-64 1867-68 1870-71 1874-75 1878-79 1882-83 1886-87 1890-91 1894-95 1858-99 | 4953 4957 4961 4965 4969 4972 4976 4980 4981 4988 4992 4996 5000 | 1774 1778 1782 1786 1790 1793 1797 1801 1805 1809 1813 1817 |

Thus there happen to be 26 Leap years in the XIXth Century, instead of 25 as is the case in the Julian, and 24 in the Gregorian Kalendars (when the latter does not begin with a Bissextile year, as A. D. 1600, 2000, &c.) which will serve to explain hereafter, why the Julian Kalendar recedes, by one day, and the Gregorian two days, from the Tamul Secular years.

ARTICLE 5.

On the limits of the number of Civil days contained in the eleven last months of the year.

With respect to the beginning of the eleven last months of the year, and the manner of deter-

The limits of the beginning of the 11 last months how discovered.

mining the number of civil days contained in each in any particular year, the initial root of the year affords likewise an Index from which the beginning of the eleven last months never recede (in their proper concurrent European month) more than two days—and never exceed beyond four: and furthermore shews, that in the present positions of the Sun's Apsis, and Equinoctial Colure, the Tamul month Maussi & (Indian February) is alone, and invariably that which anticipates the European date of the beginning of Chaitram in the New Style. (*)

Thus if the 1st Chaitram and year of the Cali yug 4847 be found to fall on the 9th April 1745 N. S. the beginning of the month of Maussi will fall on the 8th February 1746—and if the 1st Chaitram and year of the Cali yug 4918 falls on the 10th April 1816 N. S. the 1st of its month Maussi will fall on the 9th February 1817; and no other month in the year will be subject to the same subtraction.

The limits of Maussi constant in the Gregorian year, always —.

This consideration reduces the limits of the other ten months (in their concurrent European months) to the compass of four days, to be added to the date of Chaitram in its proper European month.

Those of the other 10 months always 4.

Thus if the 1st Chaitram of the year of the Cali yug 4915 falls on the 11th April 1813 N. S. none of the other months in the same year will begin later than the 15th of its own concurring European month, or earlier than the 11th.

These limits being less than a complete week, never leave the least doubt, when converting Tamul into European dates, into which of the four weeks and fraction of week the initial feria of any Tamul month elicited by the Rule, should fall according to European account.

With respect to the Sydereal and Civil duration of the Tamul months of any proposed year, it is manifest that since the initial feria of each month may be elicited by the Rule or the Tables, and since we possess the limits within which these must fall, any European Kalendar, or series of Dominical Letters, will suffice for determining the length of the proposed month.

How to determine the Civil and Sydereal duration of each Tamul month of any proposed year,

Thus let it be proposed to find the Sydereal and Civil duration of the Tamul month Auni of the year of the Cali yug 4856 (A. D. 1754-5). Having computed the initial feria and fraction for that month according to the preceding Rules, which are (vide Table D. G. V. P. X, page 13)

Tuesday (2) 4 31 32 and that for the following month Audi Friday (5) 41 9 33 and the Dominical Letter for A. D. 1754 N. S. being F (†), if we take Tuesday (A) to be the

^(*) In the Old Style Maussi falls always one day and Poongoni two days (in their respective European concurring months) behind the date of Chaitram, in its own European month; but the extreme limits continue to be five days, because the other ten months cannot exceed the European date of Chaitram in their proper concurrent month, more than three days.

⁽⁺⁾ Any Dominical Letter assumed at pleasure will answer the same purpose for the abstract duration of the month without any reference to the European Kalendar.

Ast of Auni, and count down to the Friday (D) which falls between 23 and 32 days, we find that it corresponds to the 32d day, Tuesday counted as one, which marks the first day of the Tamul month Audi, and consequently that Auni (the month for which the computation is made) contains 31 days.

Now the fraction of time annexed to the initial feria of Auni is 45 31v 32p which being below 30 guddias (page 4), shews that the month begun at day time, and therefore the Sydereal and Civil beginning coincide.

But the fraction of the initial feria of Audi is 41g 9v 33p, which shows that the month began at night time, therefore the Civil month commenced not on Friday, but on Saturday following, the Civil and Sydereal account differing by one day—therefore the Sydereal month Auni is of 31 days and the Civil of 32.

This method is so plain, that although the proposition presents three feasible cases, viz. 10 When the Roots are both below or above 30s, when the Civil and Sydereal months are of the same duration. 20 When the Root of the first is below, and that of the second above 30s, in which case the Civil is greater than the Sydereal; and 30 When the first is above, and the last is below 30s, in which case the Civil is shorter than the Sydereal month, yet the process being always the same, hardly requires any further illustration. For it is plain that if we wish to refer the same to the European Kalendars, provided the Christian date of the initial feria of the year, and the Dominical Letters according to either Old or New Style be given, then the date of beginning and duration of the twelve months of the Tamul years may always be known by their Roots without difficulty.

Thus if the initial root of the year of the Cali yug 4856 be Tuesday (2d) 418 47v 30p—the Dominical Letter for A. D. 1754 Old Style be B; and the date of the above Tuesday 29th of March, the Root for the beginning of Viassei being Friday (5d) 40g 19v 31p, if we proceed as shewn before, it will be found to fall on the 29th April, and (counting Tuesday as one) the Tamul month Chaitram will consist of 31 days Sydereal and Civil account.

And if the same be computed for the New Style, the Dominical Letter for 1754 being F, then, if *Tuesday 1st Chaitram* is said to fall on the 9th April N. S. Friday, the initial feria of Viassei will fall on the 10th May, and the first Tamul month will consist of 31 days.

Lastly, it is to be remembered when reckoning according to Civil account, that if the Civil month begins one day later than the Sydereal, it displaces by one, every succeeding day in the same month, and this until the Sun, by entering a new Sign, determines the future coincidence or dissidence of the Civil and Sydereal dates of the ensuing month.

What we have hitherto stated on the general construction of the Solar Sydereal year, will be frequently referred to in the course of this work, when it comes to treat of the resolution of the

Astronomical Luni-solar year by means of the Vukiam process, and Tables, such as it is used by the modern Tamul Astronomers; differing in this respect from the Tellingas, who still adhere rigidly to the doctrines of the Surriah Siddhanta.

The Tamul Kalendar is in itself as simple as the European, but as its columns record true time for the particular place where it is intended to be used, and as its margin is loaded with a variety of articles foreign to its immediate purpose, which require a greater knowledge of Hindu Astronomy, than the reader is at present supposed to possess, it is indispensable, in order to render that acquirement practically useful, to furnish him with the means of converting dates proposed according to the Hindu Solar account, as explained in the preceding pages, into corresponding European dates and vice versa, and to that object we shall devote the remaining part of this Section.

Should, however, the reader be desirous to inspect a specimen of the Ravi-Panchangum, or Solar Kalendar as it is published in the Southern parts of the Peninsula of India, he will find a translation of that part of it which refers to the first month of the year of Cali yug 4926 (A. D. 1825), inserted at the end of all the Tables; for we have already occasion for a greater number of technical terms in the present Memoir than is convenient, without adding to these a number of Astrological definitions, which cannot be dispensed with for understanding the Addenda of the Ravi Panchangum.

ARTICLE 6.

The manner of numbering the Indian years of the Cali yug, when referred to European accounts.

The number of years expired since the beginning of the Call yug on the birth of Christ, Dyonisian account, are 3101; therefore, the current year A. D. 1 corresponds to part of the 3102d year of the Cali yug.

Of the mra Call yugam.

It will save a great deal of future embarrassment to the reader if he notices particularly at this place, that according to established usage, the years of all the Hindu Styles are said to concur with that Christian year during which the lust expired ends. Thus if the years of the Cali yug, or Saca, which correspond to A. D. 1822 be asked of any Indian, he will call it 4923 complete, because that Solar year ends on the 11th April N.S. of the said Christian year. But as the current Indian year 4924 begins on that day, and continues until the 11th April 1823, it might otherwise be more properly coupled with the latter .- It is therefore a general rule, when any year of the Cali yug is to be deduced from the numeral of the European year to which it corresponds, that unity be subtracted from the latter before adding the epoch thereto; which is the practice followed by Father Beschi, and that which is used in the Examples given at the end of this Memoir.

1823 3101

4923

For the numeral of the year of the Cali yng, unity to be retrenched from the European year before adding the cpoch 3102. 1821 3102

4923

ARTICLE 7.

Of the æra Salivahana.

Alra Salivahana,

The beginning of the æra Salivahana dates from the birth of a Prince of that name whose history is connected with Hindu Mythology: that event is supposed to have taken place when 3179 years of the Cali yug had expired, which makes it fall 78 years after the birth of Christ.

The years when reckoned according to that account are called Saca, but differ in nothing from the common Solar year, the elements of which were disclosed in the preceding pages. It is customary in these Provinces, (and I believe in all parts of India) when dating any document, to couple the numeral of the year Saca with that of the Cali yug. Thus if the current year be asked of any Native, he seldom fails (besides other distinctions) to say, for instance "The year 4782 of the Cali yug, or Saca 1603."

Modern Astronomers make frequent use of this zera for abridging certain Astronomical computations, as will be seen hereafter in the article which treats of the Cycle of 60 years.

The current year Saca may always be determined by the following

RULE.

For the numeral of the year Saca.

| Let the year of the Cali yug complete be proposed | | | | | | subtract | 4 816 3179 |
|---|---|---|---|---|---|----------|----------------------|
| Year Saca complete | | - | - | - | | - | 1667 |
| Let Anno Domini current be proposed | - | - | - | - | _ | subtract | 1745 78 |
| Year Saca complete | - | - | - | - | - | _ | 1667 |

Or if you wish to have the three successively by one operation for A. D. 1745 current, say first 1745—1=1744

| 1745—1=1744 | - | | _ | - | 1744 |
|-------------------------------------|----------|---|---|----------|---------------|
| Add the year of the Cali yug expir | red | - | - | - | 3102 |
| At the birth of Christ, you have A. | Cali yug | ; | - | • | 4846 complete |
| Subtract epoch of Salivahana | - | | - | - | 3179 |
| You have the year Saca sought | - | - | - | - | 1667 complete |

and let it be remembered that the Christian year proposed concurs partly with the years of the Cali yug 4846 and 4847, and Saca 1667 and 1668, in the same manner that the first of each of these years corresponds partly with A. D. 1745 and 1746.

ARTICLE 8.

.Of the æra Vicramaditya.

Of the arra Vicra-maditys.

There is another zera called *Vicramaditya*, little used in the Southern parts of India. It numbers the Luni-solar years, in the same manner as that of *Salivahana* does the Solar ones.

Vicramaditya is said to have been a Prince who reigned 135 years before Salivahana, and supposed to be one of his ancestors. Its epoch begins when 3044 years of the Caliyug were expired, i. e. 57 years before Christ; so that if any year of the Caliyug be proposed, and the last expired year Vicramaditya be wanted, which let it be A. Caliyug 4925, subtract 3041

therefrom, you have 1881, the year sought. Or if the Christian year be proposed, which let be 1824; add 57, and you have 1881 as before.

ARTICLE 9.

Practical manner of determining the commencement of the Solar year.

In order to dismiss what may be farther stated on the mode of determining the beginning of the Solar year, I shall observe, independently of all computations, that there are several ways of fixing the same practically. These consist in observing the passage over the Meridian of some yoga, or Zodiacal Star (the principal one of each Lunar mansion) the position of which is given in the Hindu Tables.

Practical determination of the beginning of the Solar year.

Thus Hershana, the yoga of, and only Star in the Lunar mansion Chitra, is accounted by the Hindu Astronomers to be exactly six Signs in Longitude from the beginning of the Solar Zodiac. European Astronomers take this Star to be Spica Virginis; so that when it is observed to pass over the Meridian at midnight any where, the mean Solar year ought to begin: altho' modern Astronomers account its Civil commencement to be on the ensuing Sun rising.—Whether the original position of the Star in Right Ascension and Declination from which the Hindu Astronomers have deduced its Longitude, have been wrongly determined, as is most probable, or that they advert to another Star, our determination of the first point in the Indian sign Aries by Spica Virginis, gives a material difference in the results.

Monner of determining practically the beginning of the Solar year.

By the yoga Hershana or Spica Virguis.

I have computed its Longitude for the year of the Cali yug 3600 complete, answering to 18th March A. D. 499, when it is supposed there was no Ayanansa, and also for A. C. 4911 complete, when the Ayanansa was 19° 39′ 54″ using De Lalande's Tables, and the difference at the respective epochs were

| Longitude Spica Virginis 20th March 499 By the Ayanansa for Solar year Cali yug 3600 complete | | 6s 6 | 2° 0 | 47' 0 | | 5 3 " |
|--|------------|---------|---------|----------|----|--------------|
| | Difference | - | 2 | 47 | 50 | 53 |
| Longitude of Spica Virginis 29th March 1810 Julian Style | | | 21 | | | |
| By the Ayanansa for the year of the Cali yug 4911 complete | - | 0 | 19 | 39 | 54 | 3 |
| | Difference | | 1 | 31 | 38 | 55 |

By which quantities the yoga Hershana exceeded at the respective epochs the Longitude ascribed to it, a circumstance which would have retarded the beginning of the Solar year of the Cali yug 3601 by 2d 20h 7'—and that of 4912 by 1d 13h 11' 36".

Independently of Hershana, the yoga of the Lunar mansion Revati, supposed to be the same as ζ Piscium, and called by the Hindus Vaidhrity, is taken by them to be in the last point of the sign Min, the Indian Pisces; or what comes to the same in the first of Mesha (Aries), so that

The same by the yoga Vaidhrity.

^(*) Some pretend that this coincidence took place 39 years later: but with these contending opinions we have at present nothing to do.

when it is supposed to pass the Meridian any where at midnight, it should mark the mean Sydercal beginning of the Tamul month Arpesi, from which that of the year may be deduced; but I believe that in present times Indian Astronomers make little use of any Star for improving their account of time, or their general system of Astronomy (*), and that they content themselves for all purposes, Civil as well as Astronomical, to observe the heavens in their Books and Tables. There can be little doubt that this opposition of Hershana (Spica m) and coincidence of Vaidhrity (Z Piscium) to and with the commencement of the Hindu Solar Zodiac, never had the precision which the Indians assign to them; enough has been said, however, to shew that the manner of fixing the commencement of the Solar year indicated in the Rule given at page 8, causes it to anticipate in present times the moment of the Sun's entrance into the sign Mesha (γ) according to their own Ayanansa, by an assignable quantity of no difficult resolution.

SECTION II.

Account of the Tables.

This Section is exclusively confined to the consideration of the various processes and Tables by means of which the initial feriæ or roots of the beginning of Tamul years and months. treated of in the preceding Section, may be expounded into monthly daies, of the Christian Kalendars, for any epoch whatever; without which Hindu Astronomy can only be to Europeans a subject of learned discussion, the resolution of which can be of no sort of assistance for penetrating into the depths of Hindu Chronology, or for affording Indians any means for getting access into ours.

The following subject, although of vital importance to the utility of the rest of the work, will therefore neither gratify the curiosity of scientific men, nor serve to elicit the polemic powers of Scholiasts. The Rules and Tables hereafter disclosed consider both the Julian and Gregorian accounts: the first of these could not be dispensed with, because the Julian Style was only discontinued on the Continent of Europe on the 4th October 1582, when ten days were retrenched

Hence there is still a difference of er in European Time 8h 50m 2s.

£2 5

^(*) There will be found a Note at the end of the Volume, wherein it is shewn how the beginning of any Hindu Solar year, as accounted in the Ariah Siddhanta, may be so equated that the Sun's mean Longitude, as elicited by the European Tables for that instant of time, be in all cases equal to the Ayanansa due to the proposed year. Now having equated the time of beginning of the Solar year 3601 (A. D. 499) by the formula given in that Note, the equation was found to be 2d 11h 10m 57 \frac{1}{3}s. Eur. Time, or Indian But the equation by Hershana was 2d 20h 7m or + 2 50 17 30

from the said month, and until the 29th March 1752 when the same style was adopted in England. and eleven days were retrenched for the same reason as had determined the Gregorian reformation.

The first step towards the attainment of that object is, to establish some expeditious method for expounding the monthly date of any feria (or weekly day) that may be proposed in past, present and future times, according to the two European accounts above mentioned; and the most obvious instrument for that purpose is the Dominical Letter. But as the usual process for eliciting it is somewhat operose (*) and would take a great deal more time than the whole resolutions of the problem, I have constructed two Tables which, in the space of less than three minutes, will enable the computer to elicit the same, for any year whatever, with equal certainty.

I shall now proceed to give an account of the Tables belonging to the present Memoir.

Explanation of the

The Dominical Let-

Table I and II, page 1 and 2 of the Tables.

I notice these two Tables together, because they are both of the invention of Father Beschi, and are found in the same page of his manuscript tract on the Division of Time according to the Tamuls. The first I shall consider in the present article; the second will be noticed in that which treats of the Cycle of 90 years, used in the Southern Provinces.

Table I gives at top of the 1st column, the Root of the Ahargana for the year of the Call yug Table 1. 4802, complete: the other quantities in the second column are the Roots of years from 1 to 100 collectively taken, the figures between parenthesis being the remainder of the sum of days after division by 7, to be counted from Sunday in order to have the initial feria sought.

If therefore it be proposed to compute the end of any year of the Cali yug, which let it be 4846, take 4802 therefrom; and if to the quantity which marks the epoch in the 2d column you add 44 years (the difference), the sum will be the Root of the end of the year 4846, or commencement

Tables.

^(*) The following technical Rule in artificial verse, extracted front Hutton's Dictionary, will enable the reader to use that of the processes which he prefers, observing that the Bominical Letters of the ancient Julian Kalendar is 4 places before that of the Gregorian, the Letter A in the former asswering to D in the latter. (Mathematical Dictionary, vol. I. page 395.)

[&]quot; Divide the centuries by 4; and twice what does remain

[&]quot; Take from 6; and then add to the number you gain

[&]quot;Their odd years and their 4th; which dividing by 7.

[&]quot;What is left take from 7, the letter is given."

M. B. -The Julian and Gregorian Dominical Letters for every year from A. D. 1600 to 1900 being given in the Solar General Table, the trouble of finding the same either by Hutton's rule, or that indicated in the text, becomes unnecessary, for any of the years of the XVIIth, XVIIIth, or XIXth centuries.

of 4847; and if from the latter you subtract 3102 you will have 1745, the year of Christ corresponding thereto.

But as Beschi always computed the end of the Indian Solar year by means of the Christian one, in order to elicit the former complete, he retrenched one year from the latter, and used 3102 the current year of the Cali yug, instead of 3101 the last expired on the birth of Christ, as has been observed at page 17. The epoch given in Table I as that for 1700, is therefore truly that due to 1701.

EXAMPLE.

Let the beginning of the Tamul year which concurs with A. D. 1745 Gregorian Style, be required.

The year of the Cali yug for computation, as was shewn at page 17, will be 1745—1,—1744, or 1744+3102—4846 complete, if we use Table I; but if Table VII (page 9), it will be 1745, both of which we will use once for the sake of exemplification.

which being counted from Sunday indicates Friday the initial feria of the month Chaitram and year 4847 of the Cali yug. The reader may therefore, use either Table as may best suit his convenience.

It need hardly be said, that the quantities in the second column are the Roots for one, two, three, four, &c. years, after division of the days by 7: thus $\frac{3.6.5}{7} = 52$ weeks + (1) day, the Root for one year independently of the fraction 15g 31v 15p, and 365d 15g 31v 15p×100=36525d 52g 5v 0p and $\frac{3.6525d}{7} = 5217$ weeks with a remainder of (6) being the Root for 160 years, independently of the fraction 52g 5v 0p.

The contents of this Table will be better learnt by inspection, than by any explanation. I shall briefly state at this place, that in the first column will be found the abstract duration of each of the twelve months of the year according to the Ariah Siddhanta, and as reckoned by the modern Hindu Astronomers, in the present position of the Sun's Apsis and Ayanansa.

In the second column will be found the Roots of the same as already explained, and in the third, are registered the collective Roots of the months as they advance in the year.

Thus the abstract duration of Chaitram (γ), and consequently its end, being D. c. v. p. indicated by the Root

And the duration of Viassei & being

(3) 24 12 1

(6) 19 44 2

the collective Root for the end of Viassei will be (6)d 19z 44v 2p which is the second Root entered in the third column opposite to the Tamul month Viassei, and Hindu month Jaish'ta, the Sun being then leaving the Sign Vrisha &, and entering Midhuna II.

The utility of the third column need not be insisted upon; for it is manifest that if the Root for the end of the Solar month Auvani, or the beginning of the following month Paratasi were required, and if the positive Root of the 1st Chaitram and year for A. C. D. G. V. P. (5) 25 6 15

You need only take out of the 3d column the collective Root - (2) 26 44 6

And adding both, you have - (0) 51 50 21

at once the Root for the beginning of Paratasi of the said year, instead of having to add successively those for Viassei, Auni, Audi and Auvani, found in the second column.

Table IV, page 5 of the Tables.

This Table serves to convert hours, minutes and seconds, from one sort of time to the other. It is calculated on the respective European and Hindu division of the day, the former into 24 hours, the latter into 60 guddias, subdivided sexagesimally into viguddias, paras, suras, &c. It requires no particular explanation, and the example given at the foot of the Table will suffice to show its application.

Table V, page 6 of the Tables.

It may justly be observed, that the Dominical Letter being a contrivance of European invention, and the manner of finding it for any year that may be proposed being known to the meanest Almanac maker, a separate article on that subject in this work appears superfluous. On due consideration, however, I found it so essential to the resolution of all Hindu problems of Astronomy and Chronology, and the methods now in use for expounding it so very tedious, that I could not dispense from treating of it in a particular manner before entering into the practical part of this Memoir.

Table V is divided into two parts, the first of which shews the Dominical Letter, and day of the week beginning each Julian Secular year from A. D. 0 to 2000; or from A. Cali yug 3102 to 5102.

Feriæ heginning the centuries.

The second part shews the same for the *Gregorian* Secular years from A. D. 1500 (before which epoch that Cycle was unknown) to A. D. 2000; or from A. Cali yugam 4602 to 5102, which I call the initial *feria* of the century from which the commencement of the Hindu odd years, cannot deviate more than 3 days of the *Julian*, and 4 days of the *Gregorian* Kalendars.

The last section of this Table exhibits the same data from A. D. O, to A. Ante Christum 4004, the epoch of the Creation, according to European Chronology: concurring with A. Ante Cali yugam 903-2.

Table VI, page 8 of the Tables.

Teria which begins the proposed European year, This, like Table V, is divided into two parts, the first of which gives the number of days to be added to that which begins the century, in order to have the weekly day on which any of its odd years begin, according to the Julian Kalendar. The second part gives the same according to the Gregorian Style; and both give furthermore the day to be subtracted from the weekly day which begins the century, according as the years are Common or Bissextile, for any year before Christ, Julian Style. (*)

The figures in the body of this Table are so disposed, that they correspond to the number of days (0. 1. 2. 3. 4. 5. 6.) in the transverse column at top, which shews the number of feriæ to be applied as before said.

It may be expedient to warn the reader in this place, that the application of these Tables is much more simple than their necessary explanation seems to imply. Attention is only to be paid whether the date is to be expounded in old or new style, before or after Christ, to prevent confusion. The process according to the various cases is the same, the side of the Tables only varies. But as the mechanism of this Memoir hangs principally on Table V and VI, an attentive perusal of the following examples is recommended.

Example I. (Julian Style).

How to determine the weekly day on which the European year begins, and deduce the Dominical Letter therefrom. Let it be required to determine on what weekly day the year 1745 O. S. begins, in order to deduce the Dominical Letter therefrom.

10 Table V shows, part 1st, that the Julian year 1700 began on a Monday (the initial feria of the XVIIIth century). Now enter Table VI, part 1st, with 45 odd years; you will find over it in the transverse column at top the figure 1, which shews that one day is to be added to Monday, in order to have the feria beginning the Julian year 1745: i. e. Tuesday.

Table IX, page 12.

Having got this step and using any Kalendar wherein the Dominical Letters are inserted (vide Kalendar at the end) and taking the first letter A (which always begins the year) to represent Tuesday, you find that the Julian Dominical Letter for A. D. 1745 is F; and consequently that for the ensuing year, (which is necessary for expounding the three last months of the Tamul year) will be E.

2d Part.

Let the Dominical Letter for the same year be required according to the Gregorian Style.

Table V, part 2, shews that the 18th century began on a Friday (the feria for A. D. 1700).

With 45 odd years enter Table VI, part 2d, you find over that number in the transverse column at top, 0; which shews that A. D. 1745 Gregorian Style, also begins on a Friday.

^(*) The years after Christ do not require that distinction.

⁽⁺⁾ This Table is in all cases to be entered with the proposed odd Christian year, over a complete century.

Any Kalendar will therefore shew that since A (the first Letter in the year) represents Friday, C is the Gregorian Dominical Letter for the proposed year 1745, and that B is that for the following year 1746.

EXAMPLE II.

The same for the feria beginning A. D. 1815, Julian Style.

By Table V, part 1st, the 19th century begins on a Sunday (the initial feria for A. D. 1800) (*). Referring to Table VI, part 1st, with 15 odd years, you find 5 over it, to be counted from Sunday, i. e. Friday, the feria beginning the proposed year; which shews as before, that the Dominical Letter, Julian Style, is C, and the following BA, because 1816 is a Leap year.

2d Part (Gregorian Style.)

By Table V, part 2d, the 19th century begins on a Wednesday; and by Table VI, part 2J, (†) 15 and years give 4, to be counted from Wednesday; therefore the year 1815, Gregorian Style, begins on a Sunday, and the Dominical Letter is A, and the following year 1816, is GF, for the same reason as before stated.

OBSERVATION.

As the 17th, 21st, 25th, 29th and 33d centuries, Gregorian Style, begin with Bissextile years, the 1st part of Table VI, instead of the 2d, is to be used, because from that circumstance these years are assimilated to the Julian Style, the Secular years of which are all Bissextile.

Example III (Gregorian Style.)

Let the beginning of the year 1601 N. S. be proposed.

Table V, part 2d, shews that the 17th century begins on a Saturday (the initial feria for A. D. 1600).

But Table VI, part 1st, for 1 odd year, gives 2, which added to Saturday, gives Monday, which is the weekly day beginning the year 1601, and whose Dominical Letter is therefore G, and that for the following year F.

EXAMPLE IV.

Let the beginning of the year 1699 N.S. be proposed.

Table V, part 2d, shews that the 17th century begins on a Saturday.

But Table VI, part 1st, for 99 odd years gives 5; which added to Saturday, shews that the feria beginning the year 1699, is *Thursday*; and consequently the Dominical Letter for that year, *Gregorian Style*, is D, and the following one C.

For the Gregorian years

1679
2000
2460
2800
3200
the 1st part of Table VI is to be used.

^(*) With A. D. 1800 refer to Table V, part 1st, and you find in column 3d that the 1st January of the said year falls on Sunday Julian Style: the Dominical Letters being AG.

^(†) With the same year refer to Table V, part 2d, and in the first column you find Wednesday, which is the initial feria of A. D. 1800 Gregorian Style; the Dominical Letter for that year being E.

Attention to be pail to the Domina al Letter of the follow. ing year, whether it be Common or Bissexule.

Expounding of Dimanical Letters for ary time before Christ.

Rule,

EC a common year.

BC a Bissextile year.

Thus a very expeditious method has been instituted for finding the Dominical Letter, and expounding all the months and days in any given year since the birth of our Saviour, according to Loth European accounts, so that the only further attention which is to be paid, is to notice whether the year that follows the proposed one (the Dominical Letter of which is required for expounding the beginnings of Tye vs., Maussi and Poongoni X), be a Common or a Bissextile one.

We are now to consider how the Dominical Letter for any year before Christ, is to be determined; and this is also done by help of Table V and VI, with the following modifications.

As the years are counted increasing when ascending from the birth of our Saviour, instead of descending and increasing in the contrary case, the numbers to be taken out of Table VI, part 1st and 2d, are to be subtracted from, instead of added to, the weekly day commencing the century, for having that which begins the given year. The following Rule will provide for this case.

- 10 If the given year be a Common one, use part 2d of Table VI.
- If the given year be a Bissextile one, then use part 1st of Table VI.

EXAMPLE V.

Let the Dominical Letter for the year before Christ 550 be proposed. That year not being divisible by 4, without a remainder, is a Common one; therefore part 24, Table VI, is to be used.

Ey Table V, part 3d, we find that the year before Christ 500 (Julian Style) begins on a Tucsday, and Table VI, part 2d, for 50 years gives 6, to be subtracted from Tuesday, i. e. Wednesday; therefore the Dominical Letter for the year 550 (the 50th of its own century) is E, and that for 549 is D.

Example VI, page 8 of the Tables.

Let the Dominical Letter for the year 636 before Christ be proposed. That number being divisible by 4, without a remainder, the year is Bissextile, and therefore part 1st, Table VI, is to be used.

Now Table V, part 3d, shews that the year before Christ 600 began on a Hednesday, and Tabb VI, part 1st, for 36 years gives 3 to be subtracted from Wednesday, i. e. Sanday, therefore the Dominical Letters for the year 636 Ante Christum are AG.

N. B .- The cause of this difference is occasioned by the order of the years counted before Unlet being reversed, and that the second Letter when the year is Bissextile, is to be taken in Ante demia, instead of Consequentia, as is done for years after Christ .- Thus, if G were the Letter produced by the Rule for years before Christ, the second Dominical Letter would be F; but in ascending from the same, that Letter will still be G (as given by part 1st, Table VI), and the second Letter must be A. If we use part 1st, instead of 2d, there will be no possibility of a mistake.

How to deternine the monthly by means of the weekly date.

Laving it as found means to elicit the Dominical Letter for any given year in all possible cases

and styles, there remains no difficulty for finding the feria on which any monthly date of the same year may fall. But the converse of the proposition is by no means so apparent, because as we have seen, the manner of fixing the beginning of any year or month, according to the precepts of Hindu Astronomy, whether Lunar or Solar, is by determining the feria on which such an occurrence falls; and as there are four weeks and a fraction in every month, there is a doubt on which of these, the weekly day elicited by the Rule may fall.

For the resolution of this problem we are to have recourse to the General Index, the theory of which was given Article 5, page 15, and to Table V and VI, as shewn in the following examples.

EXAMPLE I.

Suppose that we have found by the Rule given at page 8, that the 1st Chaitram and year 4830 fell on a Sucravara (Friday), what may the monthly date of this Friday be?

т

For the Dominical Letter, and the Christian year to be registered, we have 4830—3102=1728, and let the Julian date be first required.

TT.

Table V, part 1st, shews that the 18th century began on a Monday.

Table VI, part 1st, for 23 odd years, gives 0; therefore the year 1723 began also on a Monday and the Dominical Letters (the year being a Bissextile one) are GF.

111.

Again Table V, part 1st, shows that the year Cali yugam 4802 current (corresponding to our Secular year 1700) begun on the 28th March O. S. and the year 4902 on the 29th of the same month, therefore the Friday sought must fall within two days of either of these two dates, and referring to the Kalendars, it is found to fall on the 29th March O. S.

Q. E. In.

EXAMPLE II.

The same, Gregorian Style.

1.

Table V, part 2d, shews that the 18th century New Style, began on a Friday.

Table VI, part 2d, for 28 odd years gives 6 days, therefore the year 1728 began on a Thursday and the Dominical Letters were DC.

17.

Again Table V, part 2d, shews that the year Cali yugam 4802 began on the 8th of April, and 4902 on the 10th of the same month, therefore 4830 must have begun within two days of those limits; and referring to a Kalendar we find, that the given Sucra-vara (Friday) fell on the 9th April 1728.

Q. E. I.

Examples might be multiplied, but as as the process (which is extremly simple) is in all cases the same, I shall turn to the resolution of the beginning of the last eleven menths of the year.

Resolution of the European data by means of the weekly date of the Hindu Rule.
Beginning of the year.

SECTION III.

Account of the Tables continued.

Perolation of the last cleven months of the year, We have shown at page 15, that the beginning of the Tamul year, when resolved into European time, is an Index which indicates the limits between which the first day of every month, besides Chaitram, must fall, in its preper concurrent month; and that the monthly date sought never recedes more than two days from the same (in the particular cases of the month Maussi and Poongoni X), and never exceeds it for the remaining 10 months more than four days. On this data we proceed as follows:

EXAMPLE I.

Let it be proposed to expound on what month and day of our Gregorian year 1745, Ravi-vara, 1st Paratasi m, A. Cm. 4847, happens to fall.

Į.

We find by Table III, that the Tamul month Paratasi, concurs with our month September; and by the Rule at the foot of Table I, that the 1st Chaitram and year Cali yugam 1817 began on a Sucravara (Friday), which being expounded according to the Rule given in this Article, is found to fall on the 9th April Gregorian Style, and consequently that the 1st Paratasi of the said year cannot have fallen before the 9th, or after the 13th of September. Lastly, we have found that the Dominical Letter for 1745 was C, and for 1746 B, N. S.

41.

With these data referring to any Kalendars, it follows that Ravi-vara, the Sunday to be expounded, fulls on the 12th September 1745 Gregorian Style.

The same, Julian Style.

But if we require the date Old Style, having found that the beginning of the same year fell on Sucra-vara (Friday) the 29th of March, and that the Dominical Letter was F, reasoning as before, it will be found that the same Ravi-vara falls on Sanday the 1st September O. S.

letermediate days of any repair bow to be registered.

With respect to the intermediate days of any month, it is plain that we need only count as many units as there are days between the 1st of the month and the given date, and add the sum to the European date, and vice versa, subject to what has been said on the duration of the Hindu months, at Article 5, page 15.

EXAMPLE II.

Thus it Laving been found that Ravi-vara, 1st Paratasi, A. Cm. 4817, fell on Sunday the 12th September 1745 N. S., if any other day, as Mangala-vara, 10th Paratasi, were proposed, there needs only to apply 9 days to the 12th of September, and we find that the proposed date falls on the 21st of the same month.

It is, however, to be remembered, that when any European date, whose concurrent may prove far advanced in the Tamul months, is to be expounded, as it is unknown of how many days the said month may be composed in the given year, there remains a doubt to which Hindu month the said date may belong, which to resolve, the beginning of the ensuing month must be expounded (vide Memoranda infra, page 30 and 31.)

When the European date falls near the end of the Hindu month, the beginning of the ensuing one is to be expounded and the dates established in Ascendentia.

Table VII, page 9.

Although the practice of counting by years of Christ was only introduced in Italy during the VIII to century, and in the North of Europe towards the VIII th, under Charlemagne; and even then, that there were no less than eight different manners of counting the years of Incarnation (vide Art de Verifier les dates, page 1v), yet Astronomers and Chronologists have found it expedient to establish an expost facto Kalendar, which might serve as a common scale for measuring past and future ages, altho' such a scale were unknown in the times referred to. Thus European Astronomers have protracted the Julian Kalendar, for the purpose of extending their Sydereal Tables, up to the year 800 before Christ, because the ancient Chaldaic observations ascended to that epoch, having preferred that division of time to any other, on account of its being more simple, commodious and uniform. For the same reasons, I have been induced to extend the Tables of which Father Beschi was the original inventor, to the aforesaid, and higher epochs.

The only remark to be made on this Table is, that the two last columns give, viz. the second, the epochs for the Secular years from A. D. O to 2000, according to Beschi's method, and the third, the proper Roots for the same years, the only difference being, that the former are for one year later, than the latter, as has been hinted at page 17.—These elements were both given, although either one could have been sufficient for the purpose of preventing mistakes when departing from Beschi's system.

Table VIII, page 10 and 11 of the Tables.

This Table gives the *Epochs* and *Roots* of Secular years in ascending progress, from A. D. O to the Creation, as indicated in the respective columns.

The fourth column, 1st part, gives the absolute Root of the beginning of Chaitram and year for the first 10 years before Christ, i. e. from A. Cali yugam 3102 to 3112; and afterwards from 10 to 10 years, up to 3002, concurrent with Anno Ante Christum 100. The fourth and fifth columns of the second part of the same Table give, the former the Epochs, the latter the Roots for every century as far back as A. A. C. 1000, and subsequently from 1000 to 1000 years up to A. Ante Cali yugam 903-2, the epoch of the Creation.

Thus if the beginning of a year not given in the Table be required, take the Root of that nearest to it; and complete the Rule by adding thereto for the odd years taken out of Table 1.

EXAMPLE.

ı.

| Let the beginning of Chaitram and | year 98, | Ante Christum, | be required, | concurrent with |
|-----------------------------------|----------|----------------|--------------|-----------------|
| A. Cm. 3004. | | | | |

| | | | | | | D. | G. | ٧. | F. |
|-------------------------------------|--------|-----------|---|---|---------|-------------|----|----|----|
| Root for A. C. 90, Table VIII, part | 1st, c | olumn Ist | | • | • | (5) | 41 | 22 | 30 |
| Subtract 8 years from Table I. | - | • | | - | | (3) | 4 | 10 | 0 |
| Beginning of Chaitram and year | - | - | • | • | Tuesday | (3) | 40 | 12 | 30 |
| | | | | | | | | | |

Had we worked with the Epoch, Table VIII, part 2d, the operation would have been thus:

| | | | | | | D. G. V, P, | |
|-------------------------------------|--------|-----------|---------|------------|---|-----------------------|--|
| Epoch A. D. O, Table VIII. | • | - | • | | - | (1) 16 46 15 | |
| Subtract for 90 years, Table I. | • | - | • | - | - | (1) 16 52 30 | |
| Subtract again for 9 years complete | , | • | | • | - | (6) 59 53 45 | |
| Because by notation the years are i | ncreas | ing in as | cending | , Table I. | - | — (4) 19 41 15 | |
| The same as before | - | - | • | - | - | (2) 40 12 30 | |

TABLE IX, page 12.

Exhibits the Dominical Letter for every day in the year. It requires no explanation.

SECTION IV.

MEMORANDA to be referred to in expounding dates.

Note whether the given Luropean date is likely to fall before or after 1st Chaitram. 10 In expounding any date of the month of March or April from European to Tamul time, it is necessary, before noting the concurrent year Cali yugam or Saca, to see whether it is likely to fall before or after the 1st of Chaitram, which begins about that time.

Thus suppose the 7th April 1745 N. S. had been propounded, the process indicated at page 18 would have been merely 1745+3102-4847 (1668 Saca) current.

But as we may see (Example 1st, Part II infra), that the said year began on the 9th April, it is plain that in this case, the current years Cali yugam and Saca, must be noted one less, and that the given 7th April falls on some of the latter days of the month Poongoni A. Cm. 4816, or Saca 1667.

When the given date falls before that which begins the century, take x-1 for the notation of the year.

2º. When the given date falls before that which is indicated in Table V, part 3, as beginning the century, then as the beginnings of successive years proceed like the Ayanansa in Consequentia (*), it is manifest that the year Cali yugam or Saca, instead of being noted x+3102, must be taken (x-1)+3102.

^(*) During the present Pada.

Thus if 3d April 1750 N. S. be proposed, since A. Cm. 4802 (1700—1) is shewn in Table V to have begun on the 8th April, it is manifest that the notation of the year must be (1750—1). +3102—4851; or 4851—3179—1672 Saca, and not 4852 Cm. and 1673 Saca.

But if the proposed date be 9th April 1798, observing in Table V that 4802 (1700) begins on the 8th, and 4502 on the 10th of that month, there is a doubt to which of the years 4900 or 4899 Cali yugam, the given one belongs; but the resolution of the beginning of 4900 (1798+3102) will at once resolve the question, and the year may be noted after the operation.

3º The notation of a date in Antecedentia as in the preceding case) when it falls within four days from the nearest beginning of the month,—or in Consequentia, when it exceeds 28 days from the beginning of its own month, is also a matter of doubt, and must be resolved. In both cases this depends on the number of Kalendar days counted either in the preceding or in the current month. That is, if the proposed date happens to precede the 1st Chaitram or any other month) by a few days, its notation in Antecedentia will depend on the number of Kalendar days counted in the preceding month Poongoni (or any other preceding month), which Poongoni varies from 30 to 31 days, not depending on the preceding year being a common, or a leap year, as is the case in the European Kalendar.

Notation of dates in antecedentia or consequentia, how to be determined.

Depends on the number of Kalendar days counted in the preceding or current month—not on a common or bissextile year.

In the same manner, if any date in *Paratasi* exceeding the 28th, be proposed, it will be a matter of doubt whether it does fall in that month, or in the following *Arpesi*, because that month may vary from 30 to 32 days.

In this uncertainty, the number of Kalendar days in the month where the proposed day seems to fall after addition or subtraction, must be calculated.

EXAMPLE.

Suppose we have found by the usual process that the 9th April 1798 fell on the last day of the Tamul month Poongoni X; is it to be registered in the Tamul Kalendar the 30th or 31st of that month?

RULE.

The 1st Chaitram and year Cali yugam 4900 (1798) having been found to fall v.

on the 10th April, whose Root is

Subtract therefrom the Root for Poongoni, Table III, part 2

Beginning of Poongoni 4899 Cm.

Saturday, which expounded with its proper Dominical Letter G, falls on the 10th March; therefore, in the present case, the Kalendar month Poongoni has 31 days; and the date concurrent with the 9th of April is to be registered 31st Poongoni. But if we want its notation as a Civil day, considering that the fractional part of the sum which determines the beginning of Poongoni,

viz. 47g 21v 28p exceeds 30 guddias, the Civil beginning of that month is to be registered one

Various lengths of the Tamul months, the manner of determining the same.

Notation of the day in the Kalendar as a Civil day, day later, i. e. on the 11th March. But as the fractional part of the Root of 1st Chaitram 4900 (7s 42v 30p) is below 30s, both the Civil and Sydereal day coincided on the 10th April, which makes no room for the Civil advance of the 1st Poongoni, and therefore the said Civil month will have counted only 30 days, and the proposed date, 9th April, must be registered the 30th of that month.

The reduction of epochs to different geographical positions postponed.

40 We should now consider the reduction of the epochs so computed for the Meridian of Lanca, to some other Meridian; which involves a great variety of considerations.

With respect to the mere difference of Longitude, the Indian is the same as the European process. They make their mean epochs to occur sooner or later, as the place computed for lics East or West of Lanca. The difference of Longitude of the principal places in India in degrees, Indian time and yojanas, will be found in Table XXXIII, page 43 of the Tables, as they are given in some of their Ephemerides, and will suffice to transfer the above mean epochs, from the Rec'ha (Meridian) of Lanca to any other Meridian.

Rec'ha the Meridian of Lanca.

But the case is quite different, when the true epochs, counted in apparent time from the instant of Sun rising, are to be determined (as they are in the Tamul Solar Kalendar) for any particular place which has any geographical Latitude. For the resolution of this part of the problem, Hindu Astronomers have recourse to Tropical Astronomy and to Gnomonics, in which branch of the science they have shewn much ingenuity, and a respectable knowledge of Plane and Spherical Trigonometry. But the reader is not supposed sufficiently advanced in the knowledge of Hindu Astronomy, to enter now into such topics with any prospect of advantage. I shall, therefore, postpone what I have to say on this matter, to the time when we come to consider the theory and construction of the Chandra Mana, the Hindu Astronomical year, which is its proper province Meanwhile, I shall observe that, for mere chronological purposes, such as the resolution of dates, what has been said in the preceding Articles will be found perfectly sufficient.



PART II.

To convert European into Tamul time, referred to a given Meridian.

Nothing can be more plain and simple than the Rule which elicits the weekly day marking the beginning of Chaitram and year, by means of the Tables: it remains the same and is equally expeditious for all possible cases near or remote, and may at pleasure be performed by addition or subtraction, as the computer may chuse to reckon from an antecedent or subsequent epoch. The result is equally certain, and as far as the day of the week is concerned it requires no Bija or P'hala (correction or equation), like most other Hindu problems. Thus the Rule given at the foot of Table I, teaches us every thing required on this score; for if we take the epoch either from A. D. 1700 or 1800, viz.

| | Table I. | | Table VII. |
|---------------------|-------------|--------------|--------------------|
| Epoch 1700 | (6) 2 11 15 | Epoch 1800 | (5) 54 16 15 |
| | (1) 20 50 O | Table I, 50g | (6) 56 2 30 |
| | (5) 2 5 0 | | (5) 58 13 45 |
| Weekly day, Friday, | (5) 25 6 15 | 6 | (0) 33 7 30 |
| | | | (5) 25 6 15 |

we have equally Friday arising out of the Root (5) counted from Sunday.

It would have been therefore superfluous to multiply examples, were it not for the resolution of the monthly European date concurring with the feria according to our reckoning, which (considering the interruption which our Kalendars are subject to from the introduction of bissextile years, and the two Styles) renders that part of the problem somewhat complicated.

The following Examples have therefore been chosen, to exhibit every possible case where the notation of the Dominical Letter, on which every thing depends, may require caution or distinction in order not to be mistaken. The perpetual and consequently fastidious repetition of the process will, I trust, be forgiven, on considering that the subject is a new one, and that when engaged in such operations, a reference to preceding Examples by diverting the attention, is always irksome and discouraging.

Generally, when the feria is known, a glance at Table V (last column of each division) will always show within the limits of three days for the Julian Kalendar, and four days for the Gregorian, on what monthly date the weekly day obtained by the foregoing Rule will fall. For if the Hindu year concurring with A. D. 1700, begins on the 28th, and 1800 on the 29th March

Old Style, then the Friday above elicited must fall between the 27th and 30th of the said month, and it accordingly concurs with the 29th. And if the same beginnings fall on the 8th and 10th April New Style, then the same Friday must concur between the 7th and 11th of that month, and so it falls on the 9th. When very remote epochs are considered this approximation will generally appear sufficient, but we are not therefore to neglect the means of attaining a greater degree of exactitude.

As whatever European date may be proposed to convert into Hindu time, is always clearly known to the computer by means of the particular designation it bears, a very slight attention to the notation of the date, to wit, whether it refers to before, or after the birth of our Saviour,—from the epoch of the Creation, or from that of the Hejira; also whether it be according to the Old or New Style, will be sufficient to remove any cause of uncertainty.

EXAMPLE I.

Let it be proposed to find the Tamul concurrent date to the 9th April 1745 Gregorian Style, under the Meridian of Lanca.

CAUTION.

Referring to Table V, part 2d, we find that in the Secular Christian year 1700, the Tamul year concurrent thereto began on the 8th April N. S., and in 1800 on the 10th of the same month, therefore the beginning of any year in the 18th century may fall from the 7th to the 11th April N. S; but it is doubtful whether the given date will fall in A. Cali yugam (1745+3102)=1847, or in 1744+3102=1846. We must therefore reserve the notation of the year until we know on what day of our April the Sydereal beginning of A. Cm. 4817 will fall. (*)

RULE.

| | | | | | | | D. | Œ, | Α. | P, |
|--------------------------------|--------|----------|----------|---|---|---|-----|----|----|----|
| Root for 1700, Table I. | ~ | - | • | ÷ | 2 | - | (6) | 2 | 11 | 15 |
| 40 years, do. | • | - | - | ~ | • | | (1) | 20 | 50 | 0 |
| 4 do. complete | | • | - | • | • | - | (5) | 2 | 5 | 0 |
| End of 4846, or beginning of | • | • | - | • | - | • | (5) | 25 | 6 | 15 |
| 4847 to be counted from Sunday | , i. e | , Friday | <i>.</i> | | | | | | | |

In order to find on which day of our April 1745 this Friday will fall, we are to proceed as follows:

Table V, part 2d, shews that the 18th century began on a Friday; and Table VI, part 2d, that 45 odd years give 0 day to be added thereto, in order to have the day of the week on which the year 1745 began, which therefore remains Friday, and shews that the Dominical Letter was C.

^(*) Vide Memorandum 1° page 30. In all the following Examples the years Cali yugam and Saca are noted in the proposition as current: but the year complete is always used in the resolution. For if 1745 be proposed, and 1744 be used in the computation, it is clear that we work for Cali yugam 4846 ending or 1847 commencing.

Now reverting to Table V, part 2d, column 3d, we find that the beginning of the Tamul year 4603 (concurrent with 1700) fell on the 8th of April; and as it has been observed that the beginning of the concurrent year cannot exceed that date by more than three days, referring to any perpetual Kalendar with the Letter C in the beginning of April, we find that the Friday elicited by the present Rule fell on the 9th April N. S. Hence we have the following

Table IX, p. 12.

Answer.

The 9th April A. D. 1745 N. S. is concurrent with the 1st Chaitram and year Cali yugam 4847 commencing, which shews the proper notation of the year.

N. B.—As the Gregorian Kalendar was only admitted in England in the year 1752, it may be necessary to resolve the question according to the Julian style, which is to be effected as follows:

The same according to the Julian Kalendar.

The Tamul Rule remaining as before, and the Root being Friday (5d) 25g 6v 15P a common year, we find by Table V, part 1st, that the Secular year 1700 O. S. began on a Monday, and for 45 odd years, Table VI, part 1st, gives one day to be added thereto, in order to have the weekly day beginning the year 1745 O. S. i. e. Tuesday, and consequently that the Julian Dominical Letter for that year is F.

Again, Table V, part 1st, column 5th, shews that the Tamul year Cali yugam 4802 concurrent with 1700, began on the 28th of March, and that of 4902 on the 29th of the same month; therefore 4847 must begin within the 27th and 30th, and entering the perpetual Kalendar with the Dominical Letter F about that time, we find that the Friday to be expounded falls on the 29th of March, &c.

EXAMPLE II.

Wanted the Tamul month and day corresponding to our 1st January 1813, Gregorian style, under the Meridian of Lanca.

As the proposed date falls considerably before the 1st of April, there can be no doubt but that we are to take (1813_1) +3102_4914 for the notation of the concurrent year Cali yugam (vide Memorandum 2, page 30) and that we are to work with 1812.

RULE.

| With 1800 refer to Tai Root for 10 years, Tal Do. for 1 year complet | ole I | | ch | | • • | p. c. (5) 54 (5) 35 (1) 15 | 16 1 12 3 | 5 |
|--|--------------|-------------|-----------|-------------|-------------------|--|--------------|----|
| Beginning of year and | Chaitram | 4914, | • | Friday, S | Sucra-vara, | (5) 45 | | - |
| | | | | | | a leap | yea: | r. |
| To get now to the mont | th of Tye | ve (Tamul | January), | take out of | f Table III, | | | |
| part 3d, the Root for | Margali | t, complete | - | • | • | (2) 39 | 30 1 | 1 |
| Beginning of Tye | <u></u> | phy | , sec | ź | Monday Soma-va | | 30 1 | .L |

In order to find the monthly date of this Soma-vara, we must first determine that of the Friday on which the 1st Chaitram 4914, happens to fall.

Proceeding as formerly directed, we find by Table V that the 19th century began on a Wednesday, Gregorian Style: and Table VI, part 2d, shews that for 12 years 0 day is to be added thereto, in order to have the weekly day which begins the given year; therefore, A. D. 1812 also began on a Wednesday, and consequently the Dominical Letters (the year being bissextile) are ED; and lastly, as the date proposed falls on the beginning of the ensuing year, the Dominical Letter to be used is C when expounding the three last months of A. Cm. 4914 (1813.)

Now by Table V, part 2d, column 3d, it appears that on the Secular year 1800, the Tamul year began on the 10th April, and for 1900 on the 12th of the same month. Therefore, referring to any perpetual Kalendar with the Letter D, we find that Friday, 1st Chaitram 4914, falls on the 10th of April 1812.

Again, the Rule in the present Article has shewn, that the month Tye vs (Indian January), salls on a Monday (Soma-vara).

But since the month Chaitram began on the 10th April, no other month in the same year (beside Maussi, which always begins one day sooner) can commence in its own concurrent month later than the 14th (vide page 8), and as we refer to the first days of our January 1813, the Dominical Letter to be used is no longer D, but C. Hence, referring to the perpetual Kalendar with that Letter in the beginning of January, we find that the proposed Monday falls on the 11th January 1813 N. S. the concurrent date to 1st Tye 4914.

But the date which is proposed is the 1st January; we have, therefore, an excess of 10 days, which will throw its concurrent Tamul date in the month of Margali ‡ (Indian December) and must be resolved in $Aat_{e_k}^{ce}$ dentia. (vide Mem. 30 page 31).

In order to have the correct date in Margali after subtraction of 10 days, we must determine how many Kalendar days in the given Tamul year, that month contains, for which purpose we have the following process.

| By Rule (present Article) we have Subtract Root for Margali, Table | the Root III, | for 1st¶ | | Cm. 4914 | |) 24 3) 20 5 | |
|---|------------------|----------|------------|------------|-------------------------------|------------------|------|
| Beginning of Margali, - | • | - | - | | i-vara (O | | |
| for which using the Dominical Letter | D (becau | se Marga | li is cond | current w | ith Decei | mber 1 | 812) |
| we find Sunday 13th December. Her | | | - | • | 31d in - 1 3 | | |
| And as Tye began 11th January | 65 | i i | # | • | 18 ren 11 | n. in D in Ja | |
| Number of days in the month Mar From which subtract | rgali | | | | 29 10 in | exce ss | |
| | | | 'The | ere remain | 15 10 | | |

ANSWEE.

The 1st of January 1813 falls on Sucra vara (Friday), 19th Margali, A. Cm. 4914.

N. B.—It will be found by adding the Roots of the months Tye, Maussi, and Poongoni, Table III, part 2d, to that of the beginning of Tye, found in the present Article, that the ensuing year 4915 and Chaitram, falls on Sunday, 11th April 1813, which shews that the operation has been well performed (vide General Table of Solar years XIXth century, at the end).

EXAMPLE III.

In the year of Christ 800, Easter Sunday fell on the 19th April Julian Style, Alexandrian computation: wanted the Hindu date thereof.

As it appears from Table V, part 1st, that the Tamul year Cali yugam 3902 concurrent with A. D. 800, began on (Wednesday) Bhuda.vara, the 20th March O. S. and that the Dominical Letters were ED, no further calculation is required for the 1st Chaitram of the said year.

But the proposed date is the 19th April, which is 30 days more, therefore the date required should fall on the 31st Chaitram, provided that month contains that number of Kalendar days; to ascertain which we have, as before, the following process.

| | | D. | G. | ٧. | P. |
|--|----------|-----|----|----|----|
| Epoch 800, Table VII, | . | (0) | 13 | 26 | 15 |
| Subtract one year for the Root, Table I, (vide Part I, page 13), | - | (1) | 15 | 31 | 15 |
| Beginning of Chaitram A. Cm. 3902 | Friday | (5) | 57 | 55 | ō |
| If we wish to verify the operation to the above last Root . | Friday | (5) | 57 | 55 | 0 |
| Add Root for the month Chaitram | - | (2) | 55 | 32 | 1 |
| | Monday | (1) | 53 | 27 | 1 |

which Monday being expounded by means of the Dominical Letter D, about 20th April, (because the preceding month began 20th March) we find 1st Vyassei & on the said 20th April,—therefore the month of Chaitram counts 31 days, and the Tamul date Ravivara, 31st Chaitram, answering to Sunday, 19th April, A. D. 800, has been well expounded.

EXAMPLE IV.

A Missionary wants to determine on what Kalendar Tamul year, month and day, Christmas day A. D. 1812 Gregorian style, happens to fall; and wishes to note the current year from the epoch Sucu, that of the birth of Salivahana.

RULE.

The year Cali yugam current with A. D. 1812 (18124 3102) is 4914 current; but from what has been said at page 17, the concurrent year Saca is (4914-3179) 1735.

To proceed, using as before 1312-1.

| | | | 17. | ۱, | τ. | F. |
|--|---------|--------|-------------|------|------------|----|
| Epoch for 1800, Table VII, | - | | (5) | 54 | 16 | 15 |
| Add Root for 10 years, Table I, | | • | (5) | 35 | 12 | 30 |
| Do. for I year complete, do | - | - | (1) | 15 | 31 | 15 |
| Beginning of Chaitrim and year Saca 1735 | | Friday | (5) | 45 | 0 | ō |
| 3 | | • | a | leap | year | • |
| And to get to Margali, (Indian December) add I | Root fo | r | | | • | |
| Cartia complete, Table III, part 3d, | - | - | (1) | 13 | 3 7 | 1 |
| Beginning of Margali | | Sunday | (0) | 3 | 37 | 1 |

We are now to expound these, Friday, 1st Chaitram, and Sunday, 1st Margali, for which Table V, part 2d, shews that the 19th century begins on a Wednesday, and Table VI, part 2d, that for 12 odd years 0 is to be added to the said Wednesday, to have the day of the week on which A. D. 1812 begins; which therefore also occurs on a Wednesday, and gives the Dominical Letters ED, that year being bissextile.

Now it appears by Table V, part 2d, column 3d, (page 6,) that the year Cali yugam 4903 (1800) begins on the 10th April N. S. and 5002 on the 12th, therefore the proposed year must fall about the 9th and 13th, which are its limits; and for reasons already referred to, that the 1st of Margali cannot occur earlier in December than the 9th, or later than the 14th.

With these data refer to the perpetual Kalendar with the Dominical Letter D, and you have

Friday, 1st Chaitiam, and year Saca 1745 - 10th April, Sunday, 1st Margali, - do. 13th December.

But the proposed date is 25th December, which is 12 days later, therefore Christmas day A. D. 1812, falls on Sucravara, 13th Margali of the year Saca 1735.

EXAMPLE V.

The epoch of Hejira, or flight of Mahomed, occurred on the 16th July A. D. 622 Julian Style: wanted its concurrent Hindu date.

CAUTION.

As the proposed date falls considerably beyond the beginning of April, there can be no question as to the notation of the years Cali yugam and Saca, which are, viz. Cali yug (622+3102) 3724 and Saca (3724-3179) 545, both current.

Rule.

| | | | | | | ₽. | ٠. | ₩. | F 411 |
|--------------------------------|----------|------|---|---|---------|-----|-------|-----|-------|
| Epoch for the Secular year 600 | o, Table | VII, | - | • | • | (0) | 29 | 16 | 15 |
| Root for 20 years, Table I, | • | • | : | | - | (4) | 10 | 25 | 0 |
| Do. for 1 year complete, | • | • | _ | - | • | (1) | 15 | 31 | 15 |
| Sydereal beginning of Chaitras | | | | • | Friday, | (5) | 55 | 12 | 30 |
| | • | | | | | 3 | Lleat | vea | r. |

| And to get to the Indian month Andi (25) | June, add | Root of | | D. | G. | ₹. | r. |
|--|-----------|---------|---------|-----|----|----|----|
| Auni II complete, Table III, part 3d, | • | - | ÷ | (2) | 56 | 22 | 0 |
| | | | | | | | |
| Beginning of Audi A. Cm. 3724 | • | • | Monday, | (1) | 51 | 34 | 30 |

Now to expound the Christian date of the 1st Chaitram and 1st Audi, we find by 'Table V, part 1st, that the Secular year 600 Julian Style, began on a Friday, and by Table VI, that 22 odd years give 0 day to add thereto, in order to obtain the feria beginning A. D. 622, which therefore also begins on a Friday. Hence the Dominical Letter is C, Julian Style.

But Table V, part 1st, shows that the year Cali yugam 3702 (600) began on the 19th March, and 3802 on the 20th, therefore 1st Chaitram 3724, must fall about either of those days (page 15).

Referring therefore to the perpetual Kalendar with the Letter C, near the 19th March, we find Friday, 19th March, for the beginning required.

In the same manner, since the beginning of Audi cannot fall before the 18th, nor after the 23d of June (vide Example II and IV), the same process shews that Monday, 1st Audi, falls on the 21st June; and therefore, as the proposed date is the 16th July, that it will fall 25 days later, i. e. on the 25th of Audi.

Answer.

The 16th July A. D. 622 falls on Sucra-vara, the 26th Audi, of the 3724th year of the Caliyug, and 545 Saca.

Note.—Too much attention cannot be paid when converting dates proposed in the Julian style into the corresponding date of the Tamul Solar year. For although there is no danger of mistaking the European month which corresponds with the 1st Chaitram of the year sought, its being always clearly indicated by Table V, yet if the proposed date be advanced in the year, as is the case in this Example, the eye, on taking out the European month, which let it be that corresponding to Audi, out of Table III, may hit on the 2d Section of that Table, where Audi corresponds to July N. S., instead of the 1st, where it answers to June Old Style.

Thus in the present Example, if through mistake the month Audi were taken to answer to our July (as it does in the Gregorian), instead of June, which is the corresponding month of the Julian Style, then the 16th July would be made to fall on the 29th Auni instead of the 26th Audi, which is its correct date.

EXAMPLE VI.

An European lets a house on lease to a Native, for a certain period of time, which is to expire on the 11th April 1833; the Native wants to know on what year, month and day of his own reckoning, his lease is to expire.

OBSERVATION.

As the year Cm. 5002 (1900-1) begins on the 12th April (Table V), there can be no doubt about the notation of the year, which must be (1833+3102) 4940 Cali yugam, or (4940-3179) 1761 Saca, both current.

RULE.

| | | | | | | | | D. | G. | Y. | r. |
|--------------------------------|------|-----------|----------|------|---|-----|---------|-------------|-----|------|-----|
| Epoch for 1800, Table VII, | | - | • | - | | - | - | (5) | 54 | 16 | 15 |
| Root for 30 years, Table I, | - | • | | - | | • | • | (2) | 45 | 37 | 30 |
| Do. for 7 years complete, do. | | • | • | - | • | - | | (1) | 48 | 38 | 45 |
| Beginning of Chaitram and year | 1761 | Saca or C | Cali yug | 4910 | - | Wea | lnesdag | y (3) | 28 | 32 | 39 |
| | | | | | | | | a con | amo | n ye | er. |

To expound which, we find by Table V, part 2, that the 19th century begins on a Wednesday; and by Table VI, for 38 years, that 5 days are to be added to the same for the feria beginning A. D. 1838, i. e. Monday; therefore the Dominical Letter for that year is G, Gregorian Style.

Now the Hindu year 4902 concurrent with 1800, begins on the 10th April, and 5002 on the 12th, therefore the commencement of 4940 must fall about these limits.

Referring, therefore, to the Kalendar with the Dominical Letter G, near that date, we find that Wednesday, 1st Chaitram, falls on the 11th April, which is precisely the given date.

Answer.

The Native is to surrender the house on Bhuda-vara, 1st Chaitram, A. Call yug 4940, and Saca 1761.

EXAMPLE VII.

The Chronologists reckon that our Saviour was born on the 5th year before Anno O Dyonisian æra, from which circumstance we account our time 5 years too late. What is the concurrent Hindu date with Christmas night of the said year?

CAUTION.

- 19 We are to notice when taking the Roots out of Table VIII for the odd years before Chrict, that as the centuries are increasing in notation whilst ascending, one more odd year is to be used for the end of the year expired, instead of one less. Thus had the proposed year been A. D. 5 current, we would have used 4 complete; but having to expound A. A. C. 5, we are to use 6.
 - 2º The given year is a common one.
- 30. The proposed month falls considerably after April; and the notation for the year will therefore be (3102-6) 3096 complete, and 3097 current.

RULE.

Table V, part 3d, shews that the secular year Ante Christian Æra 100, began on a Friday, and its Dominical Letters are CB; the same Table shews also, that the Hindu year Cali yugam 3002 concurrent therewith, began on the 13th of March Julian Style.

With the year Cali yugam 2096 complete, referring to Table VII, we find at once (not the epoch) but the Root for the proposed year.

D. .G. V. P.

Sunday (0) 43 38 45

And to get to the Indian month of December, referred to the Old or

Julian Style, take the Root for Margali, Table III,

(2) 39 39 11

1st Tye Vf to be counted from Sunday, i. e. Wednesday

(3) 23 8 56

To expound which, we have noticed that the beginning of A. A. C. 100 began on a Friday; and Table VI, part 1st (the year being a common one) for 95 odd years gives 0 to be added to the same for the feria beginning A. A. C. 5, which therefore also commences on a Friday, and the Dominical Letter is C.

Again Table V, part 3d, shews that the Hindu Solar year 3002, concurrent with A. A. C. 100-1, began on the 13th March, and 3102 on the 14th, therefore 3097 must have begun near either of these monthly dates. Referring therefore, to the Kalendar with the Deminical Letter C about that time, we find that Sunday, 1st Chaitram and year, fell on the 14th of March.

And as this is an Index which shews that the other months cannot have begun earlier than the 12th, or later than the 17th, in their respective months (vide Example II and IV), the same process will shew that Wednesday, 1st Tye, fell on the 15th of December. We want therefore, 10 days from the proposed date (25th December), which added to 1st Tye, the sum gives Saturday the 11th of the said month.

Answer.

The 25th December A. A. C. (the day on which our Saviour was born) answers to Sani-vara, the 11th Tye of the 3097th year of the Cali yug current.

EXAMPLE VIII.

There was a total Eclipse of the Moon on the 15th May 1631 Gregorian Style. What day was reckoned in the Hindu Kalendar when this Eclipse occurred?

REMARK.

Here we are to distinguish between computing the time of an Eclipse, which is to be effected by the resolution of time on principles totally different from those which regulate the Mudhyama Saura Mana, and expounding the day which was reckoned in any Kalendar, (let it be ever so erroneous) when that event occurred. An Eclipse which was observed on any particular day cannot be controlled by any system of Astronomy; and it's prediction, when determined on legitimate principles, can only fail by a very small quantity: it may therefore, be classed with actual observation. The present question is, therefore, only one of Chronelogy, and not of

Astronomy; for it being known that the Eclipse occurred on a Thursday, all we have to do is, to determine what date this Thursday did indicate in the Tamul Kalendar, to resolve it.

This being understood, we shall proceed as usual.

CAUTION.

- 19. As the Secular year 1600 Gregorian Style, was a Bissextile one, we are to use part 1st of Table VI for the number of days to be added to the weekly day beginning the century, to have that which commences the given year (or any other year of the same century).
- 20 The proposed date falling in May, leaves no doubt respecting the notation of the year, which should be (1631+3102) 4733 Cali yugam and (4733-3179) 1554 Saca, both current: then with 1631-1.

RULE.

| | | | ν. | ٠. | •• | •• |
|--|---|----------|-----|------|------|----|
| Epoch for A. D. 1000, Table VII, | - | • | (6) | 10 | 1 | 15 |
| Root for 30 years, Table I, | - | • | (2) | 45 | 37 | 30 |
| Beginning of Chaitram and year 1554 Saca | | . Monday | | | | |
| | | | a | leap | year | Γ. |

And to get to the month Vyassei & (Indian May), add the Root for Chaitram,

| Table III, part 3d | • | | - | - | | • | - | (2) | 5 5 | 32 | 1 |
|----------------------|---|---|---|---|---|---|----------|-------------|------------|----|----|
| Beginning of Vyassei | - | - | - | - | - | • | Thursday | (4) | 51 | 10 | 46 |

In order to expound these, Monday, 1st Chaitram, and Thursday, 1st Vyassei, we find by Table V, part 2d, that the Secular year 1600 began on a Saturday; and for the number of days to be added thereto, in order to get the feria beginning A. D. 1631, we have by Table VI, part I, (vide Caution) for 31 years, 4. Therefore, the weekly day required was Wednesday, and the Dominical Letter for that year E.

Now by Table V, part 2d, column 3d, it appears that the Hindu year Cali yugam 4702 (1600) began on the 6th April, and 4802 on the 8th; therefore, referring to the Kalendar about that time, we find that Monday, 1st Chaitram, fell on the 7th of April; and as the other months cannot begin earlier than the 4th or later than the 10th of their respective concurrent European months (Example II and IV), we also find that Thursday, 1st Vyassei, fell on the 8th of May.

But the Eclipse occurred on Thursday the 15th of May, which is 7 days later, therefore the notation of the Hindu Sydereal time is Guru-vara, 8th Vyassei, A. Cm. 4733 and 1554 Saca, under the Meridian of and at Lanca.

OBSERVATION.

With respect to the Civil day registered in the Kalendar, we are to observe that as the fractional part of the Root (51g 10v 46p) of the beginning of Vyassei, exceeds 30 guddias, the Tamul month of that name must be accounted to begin, not on Thursday, but on Friday the 9th May, Civil time, which advances the notation of every day in that month by one day. Therefore,

en consulting a Kalendar which gives only the Civil day, should we want the Sydereal day of which the Eclipse really occurred, we are to subtract one day, and suppose a fraction of at least 30 guddias reckoned from Sun rise, because the 9th Viassei so registered, is only the 8th with a fraction, as has been said.

But the Hindu Patras generally predict the Eclipses for the time from true Sun rise, in separate articles, and independently of the Civil day registered in the columns of the Kalendar.

EXAMPLE IX.

There will be an Eclipse of the Sun visible in the Eastern parts of Asia, on the 11th January 1899, at 11h P. M. referred to the Meridian of Paris.—On what year, month and day, according to the Tamul Style, is it to be expected under the Meridian of Lanca? to be expressed in Solar Time (vide remark, preceding Example, page 41.)

CAUTION.

The date falling in January, the notation of the Tamul year must be (1899—1) 1898+3102 =5000 Cali yugam, or (5000—3179) 1821 Saca, both current. (Vide Memorandum 2º page 30), and the Rule must be worked with A. D. 1898—1.

Rulk.

| | | | | | | Ð, | G. | ₹. | P. |
|-----------------------------|---|---|---|---|---|-----|----|----|----|
| Epoch for 1800, Table VII, | | | - | 2 | - | (5) | 54 | 16 | 15 |
| Root for 90 years, Table 1, | | • | • | | - | (1) | 16 | 52 | 30 |
| Do. for 7 years complete, | - | - | - | | - | (1) | 48 | 38 | 45 |

Beginning of Chaitram and year A. Cal. 5000 - Monday, (1) 59 47 30

To expound the monthly date of which, we find by Table V, that the 19th century begins on a Wednesday, Gregorian Style; and Table VI, part 2d, for 98 years gives 3 days to be added to the said Wednesday, to have the feria beginning the year A. D. 1898. The Dominical Letter is therefore B, and for 1899 A.

Now to expound the Hindu date, we find by Table V, part 2d, column 3d, that the year Cali yug 4902 (1800) began on the 10th April, and 5002 on the 12th, therefore 5000 must have fallen near those limits, for which reason refer to Kalendar at the Dominical Letter B about that time, and you find Monday the 11th April, to be the required date.

But the predicted Eclipse falls on the 11th January of the succeeding year, which to deduce

To the Root of 1st Chaitram above found

Add Collective Root for Margali 1, Table III, part 3d,

You have beginning of Tye v9, A. Cm. 5000

Thursday, (4) 39 19 41

To expound this Thursday, we are to remember that as the 1st Chaitram of this Hindu year fell on the 11th April, none of the other months of the year can begin later than the 15th of its

own concurrent month (vide Example II, page 35, and IV, page 37). Therefore referring to the Kalendar with the Dominical Letter A (because Tye falls in January 1899) about that time, you find that 1st Tye falls on the 12th January of that year.

But the proposed date is the 11th January, therefore the Eclipse will occur on the last day of Margali (the preceding month), which may count 29 or 30 days.

For the resolution of this case, observing that 1st Tye fell on the 12th January, p. c. v. r. whose Root was (4) 39 17 41
Subtract Root for Margali, Table III, part 2d, (1) 20 16 1
There remains beginning of Margali Wednesday (3) 19 1 40
which expounding with the Dominical Letter B (because we return to December 1898), about the 12th, we find this Wednesday falling on the 14th December. Hence from 31 days in

December 31
Subtract 14
There remain 17 in Dec.

Add 12 days the date of 1st Tye in January 7 12

Number of days in Margali A. Cm. 5000 - 29 days.

Hence the 11th January must be noted Bhuda-vara (Wednesday), the 29th of Margali.

But the hour of the Eclipse referred to the Meridian of Paris

Was 11h P. M. which to reduce to that of Lanca, we have
H. ' "

Hour at Paris - - 11 0 0 P. M.

And to count from the preceding midnight - 12 0 0

23 0 0 from midnight

Reduce to Longitude of Lanca from Taris, page 9, 4 54 12 E

In European Time 10 3 54 12 from midnight

Which converted info Hindu Time gives, by Table IV,

And to count from Sun rsie

Sub. 15 0 0

There remains to be counted at Lanca

O 54 45 30 from Sun rise.

Answer.

The predicted Eclipse of the 11th January 1899, which is to occur at 11h P. M. Meridian of Paris, was to be expected at Lanca, on *Bhuda.vara*, the 29th Margali, A. Cm. 5000 or Saca 1821, at 54 guddias, 45 viguddias, 30 paras after Sun rise or mean Solar time.

OBSERVATION.

As the fractional part of the Root for the beginning of Margali (19s 1v 40p as above) falls short of 30 guddias, the Civil and Sydereal day for the whole of that month will coincide, so that the notation remains the same.

It may further be observed, that retrenching the 54g 45v 40p from the ensuing Sun rise, the Eclipse will occur at Lanca on the 1st Tye, 5g 14v 30p before Sun rise, so that it will not be visible at that place.

EXAMPLE X. (*)

The most ancient Eclipse which has been transmitted to us from the Babylonians, occurred on the 19th March 720 before Christ, at 6h 48' P. M. reduced to the Meridian of Paris.—Wanted the concurrent Hindu year, month and day, under the Meridian and Latitude of Lanca. (Vide Remark, Example VIII, p. 41.)

CAUTION.

The year 720 being divisible by 4 without a remainder, is a bissextile one, and therefore we are to use the 1st part of Table VI.

The proposed date being 19th March, and Table V, part 3d, shewing that the year Cali yug 3304 (700 A. C.) began on the 7th of that month, and 3404 (600 A. C.) on the 8th, there can be no doubt that the notation of the year must be (3102—720) 2382 Cali yug.

Rule.

Beginning of Chaitram and year Cali yug 2382 current, ... Wednesday (3) 46 15 0
To expound which, we find by Table V, part 3d, that the Secular European year 700 began on
a Thursday; and Table VI, part 1st, the year being bissextile) for 20 years gives 4 to be subtracted from Thursday, i. e. Sund.y, for the weekly day which begins A. A. C. 720, and consequently its Dominical Letters AG.

Again, by Table V, part 3d, column 6th, we find that the Hindu Solar year concurrent with A. A. C. 700, began on the 7th March, therefore referring to the Kalendar with the Letter G about that time, we find that Wednesday, 1st Chaitram, and year Cali yugam 2382, fell on the 7th March 720 A. C.

But the date proposed is the 19th of March current, or 18th complete; therefore adding 11 days to the 1st, we have Ravi-vara (Sunday), the 12th of Chaitram.

Now the Eclipse occurred at 6h 48' P. M. Meridian of Paris, which to reduce to that of Lanca, we proceed as before.

^(*) This Example refers to another given in the Note for equating the Ayanausa to the European Tablez, given at the end of the volume.

| Time of Eclipse at Paris To reckon from preceding Midnight | • | - | - | • | + | #. 6 12 | .18 0 | 0 | from Noon. | |
|--|-------|--------|---|------|---|---------------|---------------|----|------------------|-----|
| Add Longitude in time from Paris to | Lanc | ea. | - | | + | | 48 51 | | from Midnight. | |
| Time in European hours, m. & s. | - | • | | _ | | 23 | 42 | 12 | Do. | |
| which converted into guddias, viguddias of Table IV. give And to reckon from Sun rise at Lanca | s and | paras, | - | mea: | | | v. 15 0 | | Do. | |
| There remains time of Eclipse Solar time. | - | - | | 3 | | 41 | 15 | 30 | from mean Sun ri | se, |

Answer.

The Hindu time concurrent to that of the Eclipse which occurred on Monday the 19th March, A. A. C. 720, at 6h 48' P. M. Paris time, is 12th Chaitram, A. Cali yugam 2332, on Ravi-vara; at 44g 15v 30p after Sun rise, Solar time, at Lauca.



PART III.

Wr. shall now proceed to give some Examples of the converse of the proposition, which differs only in the manner of stating the question, the same Rule applying to both cases.

EXAMPLE I.

A Native applies to a Collector to farm certain lands, and wants a Potah which is to bear date the 1st Chaitram, 1748 Saca. What is the concurrent date with that epoch, according to the European Kalendar?

NOTATION:

Saca 1748+3179=4927 Cali yugam,

and 4927-3102-A. D. 1825, therefore 1824 is to be used in the computation.

Rule.

To find the beginning of Chaitram and year Cali yugam 4927, proceed with 1825, as before, viz.

| Epoch for 1800, Table VII, Root for 20 years, Table I, Do. for 4 years complete, Do. | - | - | 29. 19 | | (5) (4) (5) | 54 10 | 16 25 | 15 |
|--|----|----|-----------|-------------|-------------------|----------|----------|----|
| Beginning of Chaitram and year 1748 Sac | a. | ₩, | - | Monday e | (1) com | | | |

To expound the date of this Monday, we find by Table V, part 2d, that the Secular year Cali yugam (4902) 1800, begins on a Wednesday, Gregorian Style; and 25 odd years, by Table VI, part 2d, gives three days to be added thereto, to have the weekly day beginning the year 1825; i. e. Saturday, and therefore the Dominical Letter for that year is B.

Now Table V, part 2d, column 3d, shews that the year Cali yugam 4902 (1800) began on our 20th April N. S. and 5002 (1900) on the 12th, therefore the commencement of 4927 cannot fall later than the 13th.

Referring, therefore, to the Kalendar at the Dominical Letter B about that time, we find that the Monday on which the concurrent Tamul year will begin, falls on the 11th of April; we have, therefore, the following

Answer.

The Potah bearing date 1st Chaitram, 1748 Saca, is to run from 11th April 1825.

EXAMPLE II.

A Merasi was granted to the original proprietor on the 15th Margali (1), A. 623 Saca, concurrent with A. Cali yugam 3302. Wanted the European date thereof.

NOTATION.

3802_3102=A. D. 700, and 699 to be used in the computation.

CAUTION.

- 1º Finding that the European concurrent date 700 falls considerably before the year A. D. 1582, this proposition must be expounded according to the Julian Style: therefore, part 1st of Tables V and VI, are to be used.
- 20 The proposed year, beginning the century, the Root for 1 year (1d) 15g 317 15p must be subtracted from the epoch given in Table VII.
- 30 Margali being concurrent with the time about our December, the proposed date being 15th of the Hindu month, may possibly fall in our January 701.

Ruce.

D. G. V. P.

| From Root for Epoch A. D. 76 Subtract Root for 1 year, Table | | VII, | - | - | | (0) 21 (1) 15 | | |
|---|-----------|-----------------|----------|-------------|----------|------------------|--------------|----|
| Sydereal beginning A. Ca. 3803 | 2 - | | - | • | Saturday | . / | | |
| And to get to the Hindu month l | Margali (| ‡), add | the Root | for Cartiga | | commo | n yea | r. |
| Talle III, part 3d, | - | - | | | ~ | (1) 18 | 3 7 1 | O |
| Beginning of Margali 3302. | | J . | _ | _ | Sundan | (0) 24 | 27 | 10 |

Now to expound the day on which these, Saturday, 1st Chaitram, and Sunday, 1st Margali, occur according to the European Kalendar, we find by Table V, part 1st, that the Secular year 700 began on a Thursday, and that the Tamul year concurrent therewith, began on the 20th March; therefore no further operation is required for this part of the Rule, the Dominical Letters DC being also given.

And for Sunday, 1st Margali, as it cannot fall earlier than the 18th or later than the 24th of November, referring to the Kalendar at the Dominical Letter C, we have Sunday, 21st of November.

But the proposed date is the 15th Margali, therefore adding 15 days to 21st November, we have Monday, 6th December.

ANSWER.

The Merasi being dated 15th Margali, Anno 623 Saca, was granted on the 6th December A. D. 700 Julian Style.

EXAMPLE III.

A Judge is moved to grant probate of a will, which bears date 20th Paratasi (m,) A. 1577 Saca.—To what Christian year and date, does this will refer? N. S.

NOTATION.

1577+3179=4756 Cali yug, and 1756-3102=A. D. 1654; and 1653 is to be used.

CAUTION.

The Secular year 1600 is a bissextile one, therefore we are to use part 1st, Table VI, for the Dominical Letter.

RULE.

| | | | | | | | D, | G. | ₹. | P. |
|--|-----|-----|------|-------|-----|---------------|------|------|------|-----|
| Epoch A. D. 1600, Table VII, part 2d, | - | | • | | | • | (6) | 10 | 6 | 15 |
| Root for 50 years, Table I, - | | - | | - | | | (6) | 55 | 2 | 30 |
| Do. for 3 years complete, Do | • | | - | | - | - | (3) | 46 | 33 | 45 |
| Beginning of Chaitram and year 1577 Saca | | | | - | | Wednesday | (2) | 52 | 42 | 30 |
| | | | | | | Bhuda-var | α, a | leap | y ye | ar. |
| and to get to Paratasi, take the Roct for Auvani | (R) | con | iple | te,Ta | ble | III, part Id, | (2) | 26 | 44 | G |
| • | | | | | | | _ | | | |

And to get to Paratasi, take the Root for Auvani (2) complete, Table III, part 3d, (2) 26 44 6

Beginning of Faratasi

Friday

(5) 19 26 36

Sucra-vara.

To expound these, Wednesday, 1st Chaitram, and Friday, 1st Paratasi, we have by Table V, part 2d, the Secular year 1600 (a leap year) beginning on a Salurday; and Table VI. part 1st, for the number of days to be added thereto, to obtain the weekly day which begins A. D. 1654, gives for 51 odd years 5, to be added to Saturday, i. e. Thursday; and therefore the Dominical Letter is D.

Now by Table V, part 2d, the year Cali yagam 4702 (1600) begins on the 6th April; and 4802 on the 8th; therefore 4756 must fall near those limits, and referring to the Kalendar at the Dominical Letter D about that time, we find Tuesday, the beginning of Chaitram and year, 7th April. And as any other month in the same year cannot begin sooner in its concurrent month than the 5th and later than the 10th, we also find in the Kalendar at the Letter D, that Friday, 1st Paratasi, fell on the 9th September.

But the date of the will is 20th Paratasi, therefore adding 19 days to the 9th September, we have 28, and therefore

Answer.

The will dated 20th Paratasi 1577 Saca, has for concurrent European date 28th September 1654 Gregorian Style.

EXAMPLE IV.

History records that Sevagee, the founder of the Marattah empire, died at Reiree, on Soma-vara, the 9th Chaitram, A. 1603 Saca. What is the concurrent date Julian Style?

NOTATION.

1603+3179=4782, and 4782-3102=1680 A.D.; and 1679 is to be used.

CAUTION.

As the date is to be expounded in Julian Style, we need pay no particular attention to the Secular year 1600, because all such years are bissextiles in the Julian Kalendar.

RULE.

| | | | | | D. | G. | ₹. | ۴. |
|----------------------------------|----------|---|---|---|-----|----|----|----|
| Epoch for 1600, Table VII, | • | - | • | • | (6) | 10 | 6 | 15 |
| Root for 70 years, Table I, | - | - | • | - | (4) | 6 | 27 | 30 |
| Do. for 9 years complete, Do. | • | - | - | • | (4) | 19 | 41 | 15 |
| | | | | | | | | |
| Beginning of Chaitram and year 1 | 603 Saca | | • | - | (0) | 36 | 15 | O |

To expound which, Table V, part 1st, shews that the 17th century began on a Tuesday Julian Style, and Table VI, part 1st, that for 80 odd years, 2 days are to be added thereto, in order to have the weekly day beginning the year 1680, i. e. Thursday; and consequently, that the Dominical Letters for that year are DC.

Now by Table V, part 1st, column 5th, the year Cali yugam 4702, concurrent with our Secular year 1600, began on the 27th March O.S., therefore 4782 cannot begin later than the 28th. Refer therefore, to the Kalendar at the Dominical Letter C about that time, and you will find the proposed Ravi-vara (Sunday), 1st Chaitram, to fall on the 28th of March.

But the date proposed is the 9th Chaitram, i. e. 8 days later; adding therefore 8 to 28th of March, we have the following

Answer.

Sevagee, having died on the 9th Chaitram, A. 1603 Saca, the date of this event is to be recorded as having occurred on Monday, the 5th April 1680.



NOTE.

On the Solar year used in the Southern Provinces of India and Cycle of 20 years, called Grahaparivrithi, the duration of the year being 365d 6h 12' 36" European time, and 365d 159 31v 30p Indian time. (*)

Nor having been able to procure a copy of the Vakya carana (a treatise on Astronomy), in which I was told the theory of the Cycle of 90 years is explained, I have little to say on the principles of that particular division of time. I was indeed informed by the Jyautish Sastras of Madras, that it consisted of the sum of one Revolution of the Sun, 15 of Mars, 22 of Mercury, 11 of Jupiter, 5 of Venus, and 29 of Saturn: but probably, for want of the elements used by Vararoochy (the supposed author of the Vakya carana), I never could make the collective time due to these, amount to 32873d 175 15v which is the duration of 50 years of 365d 155 31v 30p (†). But, be this as it may, there can be no doubt on the construction of the Kalendar, as it is here explained. It was analyzed by Father Beschi (from one of whose manuscripts I extracted in part the substance of the present Note) during his residence of above forty years in Madura, where he was in charge of the Portuguese mission in that and adjacent provinces.

The Southern inhabitants of the Peninsula of India use a Cycle of 90 Solar years, which is little known in the Carnatic: their Astronomers call themselves Siltandij, or of the South, in contradistinction of their Northern neighbours, whom they call the Vachij, not because that word signifies that opposite point of the compass, but because they use the Vakiam process in their computations, of which an account will be found in the second Memoir of this collection.

| (*) The European Sydereal year is The Indian | э. 365 365 | н. 6 6 | 9 | 10 30 | Anomalis | 565 365 | 6 | 15 15 | 24 |
|--|------------------|--------------|-----|----------|---------------------------|------------|------------|----------|----|
| Difference of the Indian | + | | 3 | 20 | | | | | 24 |
| The European Tropica Vachij | l year | | | | id. 5h 48 [,] 45 | ٧. | W . | , | y |
| Aria Siddhanta, Sydereal year European Tropical | | 6 1 | | 30 Y | akya carana | | 6 | | |
| Difference of the Indian | 4 | - 2 | 3 4 | 5 | | | + | 23 | 51 |

^(†) Having computed the above mentioned number of Revolutions of the Sun and five Planets by the elements at my disposition, I found the time answering thereto equal to 32985d. Ig. 1v. giving a difference in excess of 11d. 50g. 46v.

The duration of the Solar year (which is Sydereal) they divide and express in the following manner:

365d 15g 31v 30r=52 weeks +1d 15g 31v 30r=1d 15½g+1½v. Then multiplying the first member 1d 15½g by 2, they have an equation, for two years, of 2d 31g; which quantity they divide again into two unequal parts, viz. 1d 16g, and 1d 15g (independently of the second member 1½v, of which more hereafter.)

The first equation, viz. 1d 16s they add to the odd years of the Cycle of 90, and the second 1d 15s to the even ones, b ginning with the first year, with the exception of the 40th and 80th year, to which, though even, they add the first equation 1d 16s.

With regard to the odd viguddia and half of the second term of the original equation, it is to be considered that in 40 years, this quantity amounts to one guddia (or Tamul hour), which they add to the 40th year, making its duration 365d 16g 31v 15p. By this contrivance the beginning of the years of the Sittandij agrees very nearly with that of the Vachij.

Epoch A. A. C. 24, Call yaz 3073. Precept for finding the Cycles and year, expired of the Grahaparityrithi at any given epoch. The epoch to which the Cycle of 90 years refers, is when 3078 years of the Cali yug had expired; answering to A. Ante Christum 24: so that if the number of Cycles and years expired since the epoch be required, "subtract 3078 from the years expired of the Cali yug, divide the "remainder by 90, and the quotient gives the number of Cycles, and the remainder, the "number of years expired sought."

EXAMPLE.

Let the year of the Cali yug 4840 complete, be proposed. Wanted the elapsed Cycles and years of the Parivrithi.

Rule.

which shows that on the year sought there were 19 Cycles and 58 years of the æra expired; and therefore, that the current ones were the 20th Cycle and 59th year.

We may operate on the same principle if the Christian year be proposed, by reversing the process.

EXAMPLE H.

Let A. D. 1745 (Caii jug 4846 complete) be proposed; to find the Cycle and year of the Grahaparivithi.

1768. The same result as in the preceding Example.

On the construction of the year, and of Table II.

The Ahargana of the Sittandij on the beginning of the Solar year 3102.

which occurred (according to their account) on Saturday the 13th March A. D. 1 is Now if to that sum you add for 1701 of their own years, The Ahargana for the Solar year, which ended on Saturday 29th March O. S. will be 1753370d 4g, and in order to count from Sunday, instead of Friday, the Root of the same must be expressed by (6d) 4g, as was explained at pages 9 and 10; and as appears at the head of Table II as the epoch

for A. D. 1700, which quantity they call Atchù.

Construction of the ear and of Table

Atchu, an epoch to which computations

9 15

D.

621305

Remainder 1 from Friday

7)1753970(

Soota dina Saturday.

(*)

G. T.

9

1132664 54 50 45

Rule for the menths.

are referred.

For finding the circumstances of any proposed year the commencement of which has been determined, the Rule is exactly the same as that which has been explained in the Memoir on the Tamul year, the only difference being in the duration of the months, which is very trifling. It is given here merely because it represents those of the Surriah Siddhanta, within a para of time on the whole year.

| | | Names Surriah Siddhanta. | Names Tamuls. | Syde of | real each | | | | arate | Roc | ts. | Col | lecti | re Ro | ois. |
|------------|-----|-----------------------------|------------------|------------|--------------|----|----|-----|------------|-----|-----|-----|-----------|-------|------|
| | | | | D. | G. | ٧. | P. | D. | G, | ٧. | P. | D. | c. | ٧. | P. |
| $ \gamma $ | 1 | Mésha masa | Chaitram | 30 | 55 | 32 | 3 | (2) | 55 | 32 | 3 | (2) | 55 | 32 | 3 |
| 8 | 2 | Vrĭsha masa | Viassei | 31 | 24 | 12 | 4 | (3) | 24 | 12 | 4 | (6) | 19 | 44 | 7 |
| П | 3 | Mid'huna masa | Auni | 31 | 36 | 38 | 4 | (3) | 36 | 38 | 4 | (2) | 56 | 22 | 11 |
| 95 | 4 | Carcáta masa | Audi | 31 | 28 | 12 | 4 | (3) | 28 | 12 | 4 | (6) | 24 | 31 | 15 |
| Ω | 5 | Tinha masa | Auvani | 31 | 2 | 10 | 3 | (3) | 12 | 10 | 3 | (2) | 26 | 44 | 18 |
| ıψ | (| Cany à masa | Paratasi | 30 | 27 | 22 | 3 | (2) | 27 | 22 | 3 | (4) | 54 | 6 | 21 |
| ~ | 7 | fula masa | Arpesi | 29 | 51 | 7 | 2 | (1) | 5 1 | 7 | 2 | (6) | 48 | 13 | 23 |
| m | ۶ | Veischica masa | Cartiga | 29 | 30 | 24 | ı | (1) | 30 | 2.1 | 1 | (1) | 18 | 37 | 24 |
| 1 | 9 | Dhanus masa | Margali | 29 | 20 | 53 | 1 | (1) | 20 | 53 | 1 | (2) | 39 | 30 | 25 |
| | 10 | Macara masa | Tve | 29 | 27 | 16 | 1 | (1) | 27 | 16 | 1 | (4) | 6 | 46 | 26 |
| | 1 | | Maussi | 29 | 48 | 24 | 2 | (1) | 48 | 24 | 2 | (5) | 55 | 10 | 28 |
| | - 1 | | Poongoni | 30 | 20 | 21 | 2 | (2) | 20 | 21 | 2 | (1) | 15 | 31 | 30 |

^(*) The Abargana of the Vachij is 1132665d. 1g. 15v , and according to their account the Solar year 3102 began on Sunday the 14th March A. D. 1. But it may be perceived that in reality there is but 6g, 24v, 15p, difference: the fraction of days of the greater sum, being 1g., and of the lesser 51g.

There remains now only to explain how the rest of Table II was constructed.

For the Cycles.

| To the Atchu, | | bove fou | nd | - | • | | (6) 4 |
|--------------------------------------|--------------|----------|----|---|---|---|--------------------------|
| Add for 90 year | ·s | | ,5 | - | • | • | (1) 15 |
| Root for the sec And for all succ | | | • | | - | | (0) 1 9 (1) 17 |
| 3d Cycle | u | - | • | - | | • | (1) 36 (1) 17 |
| 4th Cycle | - | - | • | • | - | - | (2) 53 &c. |

For the old years of the Cycles.

The Roots of the odd years of the Cycles are obtained by adding (1d) 14s to the odd and (1d) 15s to the even ones, excepting the 40th and 80th, to which, altho' even ones, (1d) 16s instead of (1d) 15s are to be added, for the reasons explained at page 52.

The difference of two guddias (1d) 15g) added to the Atchù of the first for obtaining the Root of the second Cycle less than, for the rest is probably a Sodium, or constant quantity subtracted from the result, to fit a particular epoch, which we would term an Empyrical equation, the same being called Cshepa when additive: at least I have not been able to discover on what theory the difference is established.

Rules for finding the beginnings of the years by Table II.

In order to find the commencement of any proposed year by this Table, we must first find the number of Cycles and years expired from the beginning of the Cali yug; then take particular notice whether the remainder indicates an odd or even year; and lastly, whether it be the 40th, or 80th of the Cycle.

After summing up the Roots for the Cycles (column 1) and for the year (column 2), you are to add 31 viguddias in even, and subtract 29 in odd years, excepting the 40th and 80th of the Cycle, which require (though these be even ones) that 29 guddias be subtracted from the sam.

How to find by Table II the commencement of the Solar year of the Cycle of 90.

Let the year of the Cali yug 4847 current or 4846 complete, be proposed, and its beginning required.

4846

3102

1º From

Subtract

Christian year to be used in the computation 1744

20 90)1741 19
34 4846 90)1768(19

20 24 or by the Hindu account 3078 868

1768

19 Cycles, 58 years.

How to find the heginning of the year by the Tables.

The rest of the operation is in every respect similar to that employed in the resolution of the beginning of the Tamul year; the *Vachij* and *Sittandij* counting the Civil and Sydercal duration of the years and months in the same manner.

The Rules of the Northern and Southern Tamul Astronomers compared.

I shall conclude this exposition of the method of the Southern Astronomers, by giving some Rules for comparing its results with those of the Northern account, to facilitate which, I shall present the two Rules simultaneously expounded.

EXAMPLE I.

Let the 1st year current of the 1st Cycle current, be proposed: wanted the time of its beginning, by both Rules.

CAUTION.

1º The year 0, of Cycle 0 of the Epoch of the Sittandij, corresponds to A. Ante Christum 24 and to that of the Cali yug 3078.

20 The year is an even one.

| Sittandij. | Vachij. |
|--|---|
| For 0 Cycle, Table II, - (6) 4 For 0 year, part 2d - (0) 0 | By Table VIII, A. A. Č. for p. G. v. p. 20 years - (4) 6 21 15 By Table I, for 4 years com- |
| (6) 4 | plete (5) 2 5 0 |
| The year being an even one, add 31 | (6) 4 16 0 |
| Root of beginning (6) 4 31 | Sittandij (6) 4 31 0 |
| Hoot of Deginning (0) 4 31 | Difference Sittandij, + 14 45 |

EXAMPLE II.

Let the 41st year current of the 1st Cycle current, or 40th year complete of Cycle 0, be proposed: proceeding as before, this year will be found to correspond to A. D. 17.

CAUTION.

As 17-1=16 is to be used, this is an even year; but it is the 40th of the Cycle (vide page 53),

RULE.

| Sittandij. | Vachij. |
|--|---|
| By Table II, part 1st, 0 Cycle (6) 4 Do. part 2d, 40 years (1) 21 | Table VIII, A. D. 0 . (1) 16 46 15 Table I, 10 years (5) 35 12 30 Do. 6 years (0) 33 7 30 |
| But the year is the 40th of the Cycle, therefore subtract (0) 0 25 | (0) 25 6 15 |
| (0) 24 31 | Difference Sittandij — 35 15 |

EXAMPLE III.

Let the 46th year current of the 6th Cycle current, or 45th complete year of the 5th Cycle complete, be proposed. This year will be found to correspond to A. D. 472, and therefore 472—1=471 is to be used.

CAUTION.

This year is an odd one, therefore 29v are to be subtracted.

Rule.

| Sittandij. | | Vac | hij. | | | |
|--|-------------------------------------|---|------|-------------------|--|---------------|
| Table II, part 1st, 5 Cycles Do. part 2d, 40 years Do. 5 years | (5) 27 (1) 21 (6) 18 (6) 6 | Table VIII, A. D. 0 Table I, 400 years - Do. 70 - Do. 1 - | - | (1) (6) (4) | 6. v. 16 46 28 20 6 27 15 31 | 15 0 30 |
| But the year is an odd one, there fore subtract | | Sittandij Difference Sittandij - | - | 3.4 | 7 5 5 31 1 34 | 0 |

EXAMPLE IV.

Let the 31st year current of the 20th Cycle current, or 80th complete of the 19th complete, be proposed, it will answer to A. D. 1767; and as 1766 is to be used, it is an even one.

RULE.

| Sittandij. | Vachij. |
|---|--|
| By Table II, part 1st, 19 Cycles (2) 25 Do. 2d, 80 years (2) 42 | Table I, Epoch 1700 - (6) 2 11 15 Do. for 60 years - (5) 31 15 0 Do. 6 years - (0) 33 7 30 |
| But this year is the 80th of the Cycle, therefore subtract - 23 | Sittandij - (5) 6 33 45 (5) 6 31 0 |
| ${(5)}$ 6 31 | Difference Sittandij - 2 45 |

It will be perceived that the greatest difference between the Northern and Southern account falls on A. Cal. 3574, or A. D. 472, being 13 317.

END OF THE FIRST MEMOIR.

SECOND MEMOIR.

A KEY TO THE SIDDHANTA CHANDRA MANA

OR

HINDU LUNI-SOLAR YEAR,

TRINCIPALLY USED BY THE

INHABITANTS OF TELLINGANA, OR THE NORTHERN CIRCARS.

Written in the years 1823 and 1824.

| | | | • | |
|---|---|--|---|----|
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| ť | | | | |
| | | | | |
| | | | | |
| | | | | , |
| | | | | |
| | | | | |
| | | | | |
| | - | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | 11 |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |
| | | | | |

ADVERTISEMENT.

->>0---

On entering into the consideration of a method of dividing and recording time unlike any that ever was devised by man in ancient or modern times, the best warning that can be given to the reader is, to spare his attention by discarding all speculative matter, and to lead him speedily through a regular exposition of the doctrines on which that system is founded. I shall, therefore, offer but a few words by way of preface to this second Memoir, and these merely to prevent the reader from falling into the same misconceptions as I entertained when I began the present research.

It was imagined by some learned commentators, that the Hindu Astronomical Luni-solar year might be the same as some of those used by the ancients; and doubts immediately arose from that supposition, whether the Babylonians, Egyptians or Indians were the original inventors? To which I shall reply that, although certain features of resemblance may be discovered, yet neither the Mundane æra and year of the Jews, nor the Chaldean Saros, or Sossos (of which we know very little) have more to do with the Siddhanta Chandra mana, than any like division of time, where it was attempted to take into consideration and combine the Sun and Moon's revolutions.

The Luni-solar year of the ancients best known to us, reckoned that 99 Lunar months contained 2923 days and 12 hours; which in 60 years, gave an excess over the Sun's mean motion, of 3 days, and of 30 days in 160 years; on which account they omitted one of the intercalary months. This period being one of the three (viz. 19, 141 and 160 years) when the Hindus seem also to expunge a Lunar month, I was led, with other speculators, to suppose that the operation might be the same: but it soon appeared manifest to me from the present research, that the Hindus really expunge nothing, since it is only when a double intercalation is called for on their principles, that some other month is left out, so that when this case occurs, the year remains (as in all Embolismic years) one of 13 months, the only difference being, that the intercalation falls out of its usual place.

In the same manner, the order of the common intercalations during the Cycle of Meton appeared accidentally (from hitting on a particular period) to be the same as that of the Hindus; for the ancients divided their Cycle of 19 years into 12 complete and 7 incomplete years, which last they

intercalated so that their equations fell on the 3d, 6th, 8th, 11th, 14th, 17th, and 19th, as was the practice of the Jews; and there are truly periods when the Hindu intercalations follow the same course.

But on looking deeper into the subject I found, that the series in the Hindu Cycle was in a constant state of fluctuation; for on tracing the successive intercalations, according to Indian principles, from the origin of the Cali yug, I found that they ran successively through every p ssible change, as may be seen in the marginal note (*), a circumstance which is the necessary consequence of a system according to which nature is always suffered to follow its own course, and in which the intercalations bear only on the names of the months, and the length of the artificial year, without the least quantity being thrown in to fit the lesser divisions of time to the system.

The same thing may be said of the Luni-solar days called Tillis, these being likewise liable in appearance to intercalations and omissions, but not so in reality: for these circumstances depend entirely on the manner of coupling them with the corresponding solar days.

The truth is, that the Hindu Mathematicians seem, of all others that have existed, to be those who have shown the greatest aversion to arbitrary equations; for although in our still imperfect knowledge of their Astronomy, the Hindu system appears not to be wholly free from empiricism, yet, as far as we are able to judge, the spurious quantities which we are unable to account for, may have been thrown in by them, less from choice than from necessity.

The adherence of the Hindus to that singular species of days which they call Tidhis, so unavailing to the purposes of civil life, is a striking proof, (among many others) of their attachment to ancient usages, for if on one hand it must be admitted, that without the use of these Tidhis their whole system of Astronomy must fall to the ground, on the other, as their beginning or end cannot be known without looking into the Panchangum, because each may begin or end at any instant of the Solar day, it is difficult to conceive the cause which has

(*) Series of Introductions in the Hada Cycle of 19 years from the year 0 to 779 of the California. I rom A. Califo to,

| Ye is. | Mot. hs. | Davs. | Gtal | Viz. | | Tevolu- | | l | Se | ries | əf | Inte | rcal | tinn | ۷, |
|--------|----------|-------|------|------|--------------|---------|---|----|----|------|--------------|------|------|------|----|
| 1.2 | 1) | 7 | 11 | 55) | 7× 19 | | 1 | 0 | 3 | 6 | 9 | 11 | 14 | 17 | 19 |
| 316 | 8 | 21 | 56 | 25) | 13×19 | | 2 | 10 | 3 | 6 | 8 | 11 | 14 | 17 | 19 |
| 258 | 6 | 21 | 35 | 45) | 21×19 | 6 | 3 | o | 3 | 6 | 9 | 11 | 14 | 16 | 19 |
| 512 | 5 | 6 | 20 | 15) | 27×19 | | 4 | 9 | 3 | 5 | 8 | 11 | 11 | 16 | 19 |
| €45 | 3 | 13 | 32 | 10) | 31×19 | | 5 |) | 3 | 5 | \mathbf{s} | 11 | 13 | 16 | 19 |
| 778 | 1 | 20 | 44 | 5) | 41×19 | 7 | 6 | 0 | 2 | 5 | 8 | 11 | 13 | 16 | 19 |
| | | | | | | | τ | 0 | 2 | 5 | 8 | 10 | 13 | 16 | 19 |

Therefore in 779 years, the series of intercalations was interrupted 6 times.

preserved their notation during so many ages in their rustic Kalendars, unless it be ascribed to their predilection for Astrology.

In truth the Tidhi is now almost entirely banished from public business, excepting in that part of India which was formerly called Tellingana, better known to Europeans under the name of the Northern Circurs. But neither the testimony of the senses, nor the language of reason, could ever remove it from the moral and even physical concerns of the Indians, all believing alike, without distinction of castes or persuasions (*), that every contingency of life is ruled by the joint operation of the great luminaries of nature.—In all that relates to health, fortune, advancement, prosperity, or their contraries, the Panchangum must previously be consulted; but the ruling order of the Brahmins rigorously require from those among them who are qualified for, and willing to compute it, that they will scrupulously adhere to those sacred doctrines according to which the beginning and duration of the Tidhi is determined, a period, however, (it must be owned) which is no further imaginary than because it is manifested to the senses by no visible operation of nature, though it be as truly an assignable portion of time, as the Solar day is an assignable part of the Sun's tropical revolutions.



^(*) In the year 1800 the Author was Member of a Court Martial which had been assembled at Nundidroog for the purpose of trying a Mahommedan Sirdar of Rank named Hyder Beg, on an accusation of high treason.—
This man was honorably acquitted, and after the sentence had been confirmed, the President of the Court proceeded to the place of his confinement to announce him his deliverance.—Hyder Beg received this communication with calm gratitude, but asked leave to remain in his prison until his family might arrive to be present at his liberation, which was granted.—Two days afterwards his principal wives and children reached Nundidroog in expectation of an immediate interview; but during that interval a Brahmin Astrologer had got access to the Prisoner (himself a Mogul) and assured him that according to the Panchangum the Tidhi was an unlucky one, and that if he were to meet any of those who were dear to him pending its duration, they would feel the evil consequences ever after. Hyder Beg, though a grave and sensible old man, submitted to the imposition, and waited patiently until the end of the fatal Tidhi, for receiving to his bosom those dear objects whom, during the course of his trial, he had often thought he should see no more.

KEY TO THE SIDDHANTA CHANDRA MANA.

~~~**>>>>** 

## PART I.

#### ARTICLE 1.

ALTHOUGH there are short methods for computing the elements which are required for the construction of the Luni-solar Kalendar of the Tellingas (as it is improperly called in Madras) consistently with the doctrines of the Surriah Siddhanta, yet as these give no distinct view of the theories from which they are derived, I shall begin by computing each in Sydereal time according to the Rules of the Sastras, and show afterwards and in separate articles, how the same may be obtained by different processes.

As the division of time we are about to treat of is not a Lunar, but a Luni-solar year, the Solar Kalendar for that which it may be proposed to expound, must first be constructed, at least to a certain extent, according to the Rules delivered in the Key to the Madhyama Saura mana; such a document being indispensable at every step of the problem under consideration. The construction of the leading points of the Ravi Panchangum requires no considerable waste of time nor labour, and may be framed, by help of the Tables given at the end of the Memoirs, in the course of a few minutes, care being taken to use those which are constructed with the elements of the Surriah Siddhanta.

There are also certain quantities and expressions which are constantly required in the process, and which it is important not to mistake: Such are the names of the Hindu Signs of the Zediac, with their numerical succession, both current and complete; the absolute number of days which the Sun takes to move through each Sign, the number of complete natural days in each Solar month, both Civil and Sydereal; and lastly, the numbers which are to be added to the Solar, or Lunissolar Aharganas on the beginning of the proposed year, for obtaining the Epochs of recuirence of mean conjunctions during the whole of its duration.

My intention being to expound every case of variation to which the Luni-solar year is subject, I have selected for exemplification the year 4924 current of the Cali yug, or 1745 from the birth of Salivahana, corresponding mainly with A. D. 1822; that on which Mr. Davis has announced there would be a *Cshaya*, or expunged month, and which exhibits consequently all the changes that are to occupy our attention. I annex the Skeleton of the Chandra Panchangum for that year, in order to familiarize the reader at an early period with its singular appearance.

As every means are given in the first Memoir for ascertaining the Solar date of any Epoch proposed in European time and vice versa, and as in the present tract I shall show that the Tidhi cannot be expounded without a knowledge of the corresponding Solar date, both of which are always inserted in the Chandra Panchangum, it would be useless to enter again into an explanation of the process by means of which the dates expressed in one style are to be converted into another, but the operation will be performed without comments, whenever it may be required.

Quantities required for the computation of the Luni-solar Kalendar for the same year.

Skeleton of the Solar Kalendar for the year Cali yugam 4924, and Suca 1745 current (A. D. 1822.)

| <u> </u>                                              |                                               | <del> </del>          |            |           |          |            | _          |            |               |             |                        |                                  | <u> </u>     |
|-------------------------------------------------------|-----------------------------------------------|-----------------------|------------|-----------|----------|------------|------------|------------|---------------|-------------|------------------------|----------------------------------|--------------|
| Beginning of months European dates.                   | March                                         | April<br>May          | June       | July      | Aug.     |            |            | Nov.       | Dec.          | Jan.        | Feb.                   | March                            | April        |
| اغق                                                   | 11   12                                       | 17                    | <u>2</u>   | 7         | 12       | 15         | 6 15       | 7          | . 41          | <u>51</u> 6 | 01 01                  | 11 12                            | = 0          |
| Sign                                                  | · į                                           | 0 -                   | GN.        | 33        | 4        | e.         | ල<br>      | <u></u>    |               |             | 20                     | 1                                | 0            |
| Current                                               | 12                                            | - 61                  | <u></u>    | 4         | ę,       | 9          | <u></u>    | 30         | 0             | 01          | -                      | 12                               |              |
| Types.                                                | *                                             | ⊱x                    |            | မ         | රස       | 区          | <u>{ </u>  | E          | *             | 3           | <b>₹</b>               | *                                | 7            |
| Names of<br>Zodiacal<br>Signs,                        | Min                                           | Mésha<br>Vrľsha       | Mid'huna   | Carcáta   | Sinha    | Canya      | Tula       | Vrischica  | Dhanus        | Macara      | Cumbha                 | Min                              | Mésha        |
| Civil<br>distrib<br>of<br>anouths                     |                                               | 8 8                   | 31         | 23<br>23  | <u></u>  | <u>ج</u>   | 8          | ဇ္တ<br>    | <b>64</b>     | 29          | 30                     | တ္တ                              | 30           |
| Syderesl<br>duration<br>To<br>months.                 |                                               | 30<br>31              |            |           |          | _          |            | 30         | 30            | •           | 50                     | 30                               | 30           |
|                                                       | P. 36                                         | 12                    | 32         | 16        | 58       | ဆို        | 10         | 51         | 24            | 53          | 25                     | 58                               | 3 34         |
| beg<br>non(                                           | , <del>,</del> ,                              | 44                    | 12         | 15        | 17       | S:         | 23         | . 25       | 28            | 8 30        | 33                     | 3 35                             | 9 38         |
| of r                                                  | D. G                                          | 38 38                 | ٠.         |           |          | 9 22       |            | 51         | 1 15          |             | 9.24                   | 37 48                            | 58           |
| Roots of begin-<br>nings of months.                   | Roots D. G. v. (2) 22 I7 4                    | 1) 42                 | €<br>€     |           |          |            | 36         | 30         | · (6)         | ) 22        | (1) 49                 |                                  |              |
| 1                                                     |                                               | <u>£</u> 6            | <u> </u>   | <u> </u>  | <u>€</u> | <u>e</u>   | <u>ම</u>   | <u>(4)</u> | ဗ             |             | <u></u>                |                                  | (5)          |
| Names of<br>Solar<br>months.                          | Poongoni                                      | Chaitram<br>Vvassei   | Auni       | A udi     | Auvani   | Paratasi   | Arpesi     | Cartiga    | Margali       | Tve         | Maussi                 | Poongoni                         | Chaitram     |
|                                                       |                                               | ···········           | =          | ==        |          |            |            | ==         | 5~            | <b>^</b>    | ==                     | ميم                              | Ī            |
| Names of Lunisolar solar months.                      | Chaitr <b>a</b>                               | Vaisácha<br>Jvaishtea | A'sha'd'ha | Sra' vana | Bha'dra  | Aa A'swina | Na A'swing | Ca'rtica   | Csha, Sasiras | Ma'ch       | P'ha'lguna             | Aa Chaitra or<br>Phalguna Mitiek | Na Chaitra   |
|                                                       | 2 . ±                                         | 39                    | ₹          | 46        | 56       | +*         | 39         | 12         | 43            | 1.5         |                        | 65                               | 30           |
| S                                                     | ъ.<br>31                                      | 64 12                 |            | 10        |          | ,,         | 18         | ٠,         | 23            | 96          |                        | 31                               | 63           |
| ctive nuays of months.                                | 31                                            | 35.                   |            |           |          |            |            |            | 30            | 3 46        | 22                     | 5 31                             | 5 3%         |
| day                                                   | P. <b>D. G. V.</b><br>0 365 15 31             | 55 0                  | 3 56       | 5 24      |          | 54         | 3.48       | 3 18       | 5 39          | 5           | 100                    | 5 1                              | 30 55 39     |
| ತ್ತಿ ಕ                                                | 36.                                           |                       | 93         | 125       | 156      | 981        | 49 216     | 56 246     | 3 275         | 30          | 7 33                   | 36                               | !!           |
| lays                                                  | . O                                           |                       | 21         | 86 (      | 35       | 777        |            |            |               | ]           | -                      | 63                               | 33           |
| Collective Collective number of days of in Lunations. | ; o                                           | 1 50<br>2 40          |            | 7 2       | 39 10    | 11         | 49 50      |            | 46 31         | 8           | 324 50 11 17 334 55 10 | 354 22 1 24 365 15               | 383 53 51 31 |
| Coll                                                  | D. G.                                         | 29 31<br>50 3         | 35         | 00        |          |            |            |            | 265 4         | 15.1        | 24.5                   | 5 <del>7</del> 5                 | 33 £         |
| E.=                                                   | <u>  a                                   </u> | 6, 4                  | 88         | =         | -        | 13         | 20         | 253        | 26            | -6          | 8                      | જેં                              | 185          |
| Number of<br>Lunations.                               | 0                                             | Lunations 1           | 1 07       | 4         |          | 9          | 7          | - 00       | . o           | 2           |                        | 13                               | 13           |
| Years<br>current.                                     | 4923                                          | 4924                  |            |           |          |            |            |            |               |             |                        |                                  | 4925         |

How to find the Solar Ahargana for the 1st Chaitram of the year 4924 of the Cali yug, by means of Table XLVIII according to the Surriah Siddhanta.

| Y\$.                                   |     | Ö.                 | ပ      | ۲.         | ъ. | \$ |  |
|----------------------------------------|-----|--------------------|--------|------------|----|----|--|
| Part 2. Columns 3 and 4. for 4000      | 1   | 1 161035           |        | 23         | 20 | 0  |  |
| do. , 900                              | ښ   | 328732             | 52     | 51         | 0  | 0  |  |
| Columns 1 and 2 - 20                   |     | 7305               | 10     | 30         | 28 | 0  |  |
| do.                                    |     | 1005               | 46     | 34         | 34 | 12 |  |
|                                        | 121 | 1798168 51 29 29   | 51     | 66         | 53 | 13 |  |
| Sodhyam or Equation                    | 1   | હર                 | &<br>& | 51 15      | 15 | 0  |  |
| Ahargana 1st Chaitram 4924             | 17  | 1798166 42 38      | 57     | 38         | 7  | 12 |  |
| Subtract absolute duration of Poongoni | - 1 | 30                 | 50     | <u>2</u> 1 | 63 | 30 |  |
| Ahargana 1st Poongoni 4923             | 14  | 1798136 22 17 4 36 | 22     | 17         | 4  | 36 |  |

| Divide each Ahargana by 7)17981667256880 weeks  For Chairram 4924 remainder 6 which counted from Friday gives  Thursday, which according to Tabular expression counting from |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|

7)1798136(256876 weeks
Remainder 4 which counted from Friday gives
Tuesday; and according to Tabular expression counting from Sunday
is to be noted (24) 23g 17v 4p 36s as above.

Constant Quantities required for the Construction of the Kalendar of any Luni-solar year.

|    |                 | Names of<br>Solar<br>months. |    | in         |    | h |            | Separa | te I | loo: | ts ( | of do.     | Collec |    | R<br>lo. | oots | of         | European months N. S. |
|----|-----------------|------------------------------|----|------------|----|---|------------|--------|------|------|------|------------|--------|----|----------|------|------------|-----------------------|
| 1  | r               | Chaitram                     |    | G.<br>55   |    |   |            | Roots  |      |      |      |            | Roots. |    |          |      |            | April                 |
| 2  | ಶ               | Vyassei                      | 31 | 24         | 12 | 2 | 41         | (3)    | 24   | 12   | 2    | 41         | (6)    | 19 | 44       | 5    | <b>2</b> 0 | May                   |
| 3  | П               | Auni                         | 31 | 36         | 38 | 2 | 44         | (3)    | 36   | 38   | 2    | 4.1        | (2)    | 56 | 22       | 8    | 4          | June                  |
| 4  | æ               | Audi                         | 31 | 28         | 12 | 2 | 42         | (3)    | 28   | 1,2  | 2    | 42         | (6)    | 21 | 34       | 10   | 46         | July                  |
| 5  | ${\mathfrak C}$ | Auvani                       | 31 | 2          | 10 | 2 | 40         | (3)    | 2    | 10   | 2    | 40         | (2)    | 26 | 44       | 13   | 26         | August                |
| 6  | Ą               | Paratasi                     | 30 | 27         | 22 | 2 | 38         | (2)    | 27   | 22   | 2    | 38         | (4)    | 54 | 6        | 16   | 4          | <br> September        |
| 7  | ≏               | Arpesi                       | 29 | 5 <b>4</b> | 7  | 2 | 35         | (1)    | 54   | 7    | 2    | 35         | (6)    | 48 | 13       | ,18  | 39         | October               |
| 8  | η               | Cartiga                      | 29 | 30         | 24 | 2 | 33         | (1)    | 30   | 24   | 2    | 33         | (1)    | 18 | 37       | 21   | 12         | November              |
| 9  | 1               | Margali                      | 29 | 20         | 53 | 2 | 31         | (1)    | 20   | 53   | 2    | 31         | (2)    | 39 | 30       | 23   | 43         | December              |
| 10 | VS.             | Туе                          | 29 | 27         | 16 | 2 | 32         | (1)    | 27   | 16   | 2    | 32         | (4)    | 6  | 46       | 26   | 15         | January               |
| 11 | ***             | Maussi                       | 29 | 48         | 24 | 2 | <b>3</b> 3 | (1)    | 48   | 24   | 2    | 33         | (5)    | 55 | 10       | 28   | 48         | February              |
| 12 | ×               | Poongoni                     | 30 | 20         | 21 | 2 | 36         | (2)    | 20   | 21   | 2    | 3 <b>6</b> | (1)    | 15 | 31       | 31   | 24         | March                 |

The Roots between parenthesis to be counted from Sunday: But those given in the present Table being absolute, are never expounded but when combined with the initial Root of the proposed year. Vide marginal note of Table III (Madhyama Saura Mana),—the only difference being in the quantities, which in that Table are derived from the Elements of the Ariah Siddhanta.

Skeleton of the Siddhanta Chandra Panchangum, for the Meridian and Latitude of Madras, for the 4924th Luni. solar year of the Cali yug.

|                | (.01)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |          |
|----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------|
| swina. 7.      | Soncha   S   |          |
| Adigah Aswina. | 2 Mon                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 67       |
| ովա, 6.        | Southa<br>Pathum. Adigah.  Trahi.  Trahi.  Trahi.  Trahi.  Trahi.  Trahi.  Trahi.  Trahi.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |          |
| Bha'drapada,   | 8 Sat   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 30       |
| 5.             | Souchal<br>Pachum. Pachum. Chuishna Chuishna Chuishna Andraya. Amavasya.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 8        |
| Sravana        | 6 Fri 17 Sut 9 Sun 11 Twee 12 Sun 110 Twee 12 Sun 110 Twee 12 Sun 110 Twee 12 Sun 12 Sun 12 Sun 12 Sun 12 Sun 13 Sun 14 Sun 15 S | 63       |
| 4.             | Soocha Pachum 4 Cshaya. Adigah. Adigah.  Ridhi Chrishna Rachuu. Bachuu.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |          |
| Asha'd'ha'.    | 8 Thurs 11 8 11 8 11 8 11 8 11 8 11 8 11 8 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 29       |
| irta. 3.       | 1 Soocha<br>2 Pachum.<br>5 6<br>6 6<br>6 7<br>10 Purnima<br>11 Trichi.<br>12 Pachum.<br>13 Pachum.<br>14 Adigah.<br>5 5<br>6 7 Cshaya.<br>16 10 II.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |          |
| Jaish          | 110 Tues 111 Wed 112 Thurs 113 Ent 115 Sun 115 Sun 116 Sun 117 Tues 118 Wed 119 Thurs 119 Thurs 120 Sun 120 Med 130 Men 131 Tues 132 Sun 133 Tues 134 Tues 135 Sun 14 Sun 15 Med 15 Med 16 Tues 18 Sun                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ខ្ល      |
| ha. 2.         | 22 Pathum. 35 66 66 11 11 11 11 11 11 12 13 14 15 16 16 16 17 18 18 19 19 10 10 11 10 11 11 11 11 11 11 11 11 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |          |
| Vaisacha.      | 119 Mon 119 Mon 119 Mon 119 Mon 110 Fin 111 Sut 111 Sut 111 Sut 112 Sut 113 Sut 113 Sut 114 Wed 125 Sun 125 Sun 126 Mon 127 Thers 127 Sut 128 Sun 138 Sun 138 Sun 148 Sun 158 Sun                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 63       |
| a. I.          | Soocha  Soocha  B Pachum.  B Pachum.  C S S S S S S S S S S S S S S S S S S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |          |
| Chaitra.       | Poongoni   13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | <b>8</b> |

Purnima Tridhi. Chrishna Pachum, Amavasye. Soocha P. Cshaya. Chaitra, 0-0047- | 00400-0100-30000000 Sun Mon Tues Wed Thurs Fri Sat Sun Mon Tues Wed Thurs Fri Sat Sun Mon Tues Wed Thurs Sun Mon Tues Wed Thus Fri Sat |Chaitram | 1 Sat Purnima 19 Trdhi, 18 Chrishna 14 Pachum, 14 16 18 19 19 19 19 19 8228228 Cshaya, Amavasya. Soucha Pachum, Adigah. Adigah Chaitra, or Phalguna - itiek. 9 10040-00: Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed 2828833 328828 8 Purnima Tidhi, Chrishna Pachum. Soocha Pachum, Ama. ŝ × -004 12-x00=5 10410-0104 100 E 30 O C Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Sun Mon Trues Wed Thurs Fri Sat 28 Sun 29 Mon 30 Tues Poongoni 1 Wed 288888 3 Purnima Tidhi. Chrishna Pachum. Amavayaa. Soocha Pachum. Adigab. II, 5 HTOT Magha, Mon Tues Wed Thurs Fri Sat Sun Mon Tues Wed Thurs Fri Mon Tues Wed Thurs Fri Sat Sun Mon Tues Wed Thurs Fri 59<u>5</u>56 33233253 Purnima Tidhi, Chrishna Pachum, A Soocha Pachum, Cshaya. Ama. Adigab. Cshaya Margasiras, Paushia, 10, 3 - 0x 0x 4 0 0 1 0 0 1 0 0 0 4 0 1 - 0x 0x 0 0 1 0 0 Sun Mon Turs Wed Thurs Fri Sun Mon Tues Wed Thurs Fri San Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Sun Cshaya. mayasya. m Soocha ] Adigah. ó 10-04-01 64.00-00 Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Tidhi. Chrishna Pachum. Purnima Cshaya, mavasya. Soo. 1 △ Soo. Adigah. • Aswina, ver∞00 1 | 00 2 4 70 — 3₹ es 1261.000= | SE45 Arpesi 1 Tues 2 Wed Yed Fri Fri Sun Mon Tues Wed Thurs Fri Sat Sun Mou Tues Wed Thurs Fri Sun Mon Tues Wed Thurs Fri Nija Sun Mon Tues Wed

8288818818888

The Siddhanta Chandra Panchangam, continued.

# ARTICLE 2.

# General account of the Siddhanta Panchangum.

The Luni-solar year under consideration is accounted to begin at the true instant of conjunction, or new Moon, which precedes the commencement of the Solar year, with which it is mainly to concer; and is to be distinguished from the Bhanu Husputtia mana, which commences with the full Moon which precedes the same, the months of the former being termed Mullya, or primary; those of the latter, Gauna, or secondary. The Bhanu Husputtia mana is not used in these parts of India.

The Chandra Mana is divided into twelve months, subject by intercalation to a thirteenth month, each, whatever be its real duration, being divided into 30 Tidhis.

# Names of the Lunar months.

| 1 | Chaitra.   | 5 | Sravana             | 9  | Margasiras or<br>Agrahayan |
|---|------------|---|---------------------|----|----------------------------|
| 2 | Vaisacha   | 6 | Bha'drap <b>ada</b> | 10 | Paushia                    |
| 3 | Jyaish'ta  | 7 | Aswina              | 11 | Magha                      |
| 4 | A'sha'd'ha | 8 | Cartiga             | 12 | Phalguna.                  |

Names of the Lunar monais.

The month is divided into two parts of 15 Tidhis each, called Pacsha or Pachum, the first fortnight being denominated Sukla or Soocha (the enlightened), the second Chrishna or Bakoola (the dark) half of the month.

A Pac.ha 15 Tidhis.

Names and duration of the Solar months, (Surrich Siddhanta.)

Names and duration of the Solar months.

|    | Bengal.      | Tamul.   | Ī        | Absolute duration of each. |            |          |         |          | The same collectively. |          |          |         |          |
|----|--------------|----------|----------|----------------------------|------------|----------|---------|----------|------------------------|----------|----------|---------|----------|
| 1  | Vaisa'cha    | Chaitram | r        | D. 30                      | б.<br>55   | v.<br>32 | P.<br>2 | 5.<br>39 | D.<br>30               | G.<br>55 | v.<br>32 | P.<br>2 | s.<br>39 |
| 2  | Jyaish'ta    | Vyassei  | b        | 31                         | 24         | 12       | 2       | 41       | 62                     | 19       | 44       | 5       | 20       |
| 3  | A'sha'd'ha   | Auni     | П        | 31                         | 36         | 38       | 2       | 44       | 93                     | 56       | 22       | 8       | 4        |
| -1 | Sra'vana     | Audi     | 9        | 31                         | <b>2</b> 8 | 12       | 2       | 42       | 125                    | 24       | 31       | 10      | 46       |
| 5  | Bha'drapada  | Auvani   | S        | 31                         | 2          | 10       | 2       | 40       | 156.                   | 26       | 44       | 13      | 26       |
| 6  | A'swina      | Paratasi | my       | 30                         | 27         | 22       | 2       | 38       | 186                    | 54       | 6        | 16      | 4        |
| 7  | Ca'rtiga     | Arpesi   | _        | 29                         | 54         | 7        | 2       | 35       | 216                    | 48       | 13       | 18      | 39       |
| 8  | Ma'rgasi'ras | Cartiga. | π        | 29                         | 30         | 24       | 2       | 33       | 246                    | 18       | 37       | 21      | 12       |
| ٤  | Paushia      | Margali  | 1        | 29                         | 20         | 53       | 2       | 31       | 275                    | 39       | 30       | 23      | 43       |
| 10 | Ma'gha       | Туе      | w        | 29                         | 27         | 16       | 2       | 32       | 305                    | 6        | 46       | 26      | 15       |
| 11 | P'ha'lguna   | Maussi   | <b>#</b> | 29                         | 48         | 24       | 2       | 33       | 334                    | 55       | 10       | 28      | 48       |
| 12 | Chaitra      | Poongoni | ×        | 30                         | 20         | 21       | 2       | 36       | 365                    | 15       | 31       | 31      | 25       |

The duration of these months, which is derived from the elements of the Surriah Siddhanta, and is that used by Tellinga Astronomers, differs from that which proceeds from those of the Ariah Siddhanta only in the ratio of  $\frac{0.6}{3.6.5}$ ,  $\frac{6.5}{1.5}$ ,  $\frac{7.9}{31}$ . The Tamul Astronomers, however, prefer the latter, even in their Lunar computations; and on that account the Solar Ahargana given in the General Table II, was computed with the Solar year of 365d 155 31v 15p.

The instant of true conjunction which determines the commencement of the month is called Arca-Indoo-Sanyama, literally meaning conjunction of the Sun and Moon. It is also called Durcham, but more generally Amavasya.

Amavasya Tidhi. Day of conjunction.

Although the instant of conjunction be that which determines the commencement of the year or month, yet the day on which it occurs, and which on that account is called the Amurasya Tidhi, is always reckoned in the Kalendar, as well as in account, as the SOth Tidhi of the Lunar month, because it ends on that instant. The Prathama or first Tidhi of the ensuing month is always accounted to be the next, for the same reason.

Parnima Tidhi. Day of opposition. The day of opposition is called Purnima Tidhi, and is always the 15th of the first Pacsha (\*). The names of each Tidhi in each Pacsha or fortnight, are as follows:

Names of the days of the Pacsha.

| 1 | 1  | Padyami 1       | 6  | Shusti  | 11 | Yacadesi   |
|---|----|-----------------|----|---------|----|------------|
|   | 2  | Vidya er Duitia | 7  | Surtami | 13 | Duadesi    |
|   | 3  | Tadya           | 8  | Astami  | 13 | Tryadesi   |
|   | .1 | Chouti          | 9  | Navami  | 14 | Chaturdesi |
| ı | 5  | Punchami        | 10 | Desami  | 15 | Pavarnami  |

These names, which are merely numerals, will probably strike the reader, from their frequent resemblance to Lutin words of the same import.

In the Fanchangum the days are numbered no farther than fifteen, but in computations the series is followed up to thirty. It is, however, customary in numbering the last Pacsha in the Kalendar, to mark the 15th or last Tidhi (Pavarnami) the 30th, although the preceding one be noted the 14th and sometimes the 13th, unless the said 30th or Amavasya Tidhi should happen to be a Cshaya or expunged day; in which, and similar cases, it would be left out of the column, and (together with its duration) noted in the margin. The last day of the month when this occurs is registered the 14th; as was the case in the month of Vaisacha of the year 4921 (†) current.

Although the Cycle of 60 years (Vrihaspati) has no immediate reference to the Chandra

<sup>(\*)</sup> The Tamuls, and generally the Natives on the Coast, where their language is prevalent, with few exceptions, pronounce very badly all these names; and when they write them in Inglish, it is difficult to recognize them. I have followed Sir William Jones, Mr. Davis and Mr. Scot's orthography, and I think it desirable that it should be maintained.

<sup>(+)</sup> Vide Kalendar, page 67.

Mana, yet I find in an old manuscript in my possession, that the Southern Astronomers use it for obtaining the Ahargana (\*). The practice, however, not being general; I barély mention it. But it is customary every where to annex the name of the concurrent Vrihaspati year to the preposed Chandra Mana. (†)

This, and other practices, lengthen considerably the common manner of dating letters and other documents, for if an inhabitant of the country which is still sometimes called Tellingana, wishes to be very precise in dating a letter or bill of exchange, which let it be the 20 Tidhi of the intercalary month Assina of the Luni-solar year Cali yugam 4924; his notation will be as follows:

Manner of dating.

"Chitrabhanu sumvat saram; Adigah Aswina; Suddha Duitya, Mangala-vara, Cali yugam "4924; Saca 1715."

#### ANGLICE.

In the year Chitrabhand (the 16th of the Cycle of 60 Te'linga account)—of the intercalary month Aswina the 23 day,—Tuesday; Ao Cali yugam 1921, and Saca 1745.

Marner of dating in Tellingana.

I am informed that this style in ancient times generally prevailed in all Tel'ingana; not only for private, but for public transactions. In latter times, however, it was found so extremely inconvenient (particularly since the introduction of the British power), that it was banished from all cutcheries, and the Solar Kalendar became that of the state. It is, however, still retained by the Brahmins, and most merchants at Masulipatam, Vizagapatam, Ganjam, and other places in the Northern Circurs.

The Solar Kelendar, that for public business.

The following terms and definitions require particular attention.

10 When the year is a common one, it is called by the general name of Sumvat suram, or mana.

Sumvat saram, name of a common year.

- 2º An intercalary year Aaigah Sumvat saram.
- 30 A double intercalary year, and consequently affected with an expunsed month—Cshaya Sumvat saram.
  - 40 When a month is intercalated, the word Adigah is prefixed to it (meaning added). Thus

Adigah Sumvat saram, an interculary year.

Cshaya Sunvat saram, a double intercalary year with an expunged month.

<sup>(\*)</sup> What follows is a literal translation of the article referred to.

<sup>&</sup>quot;Three things are requisite for determining the time of an Eclipse, viz. 1. The Soota dina, or the last of the number of days which have elapsed since the Epoch fixed upon by the Author of the Rele. Now that Epoch falls on the 12th year of the Indian Cycle of 60 years; and there are elapsed (so it is supposed) 80 of these Cycles until the year 1747, when the Cycle began onew. So multiplying 60 by 80, and Alding 43 years to the product (48 years remaining of the first Cycle), you have the number of years that have passed up to the year 1747. Moreover, multiply the total sum by 365 days, 15 marikas, 31 vinadis (the Passal manes for guddias and viguidias) and 15 tarparys (paras); add thereto the number of months, days, minutes, &c. elapsed since the Astronomical or true beginning of the current year, and you have the precise day sought, &c. &c."

<sup>(+)</sup> These names are inserted in the General Table I given at the end of the Tables.

Adigah Aswina "interculated Aswina" and Nya (or proper) to the second, repeating the name of the month.

- 50 In the case of two intercalations in the same year, Tellinga Astronomers call indistinctly the second interculation by the name of the month which occasions it, or by that of the preceding itiek to it. Thus in the Patra for the year 4924 the last Adigah may either be called, Adigah Chitra, or Phalguna - itick.
- 60 When an expunged month occurs, the name of that on which it falls is coupled with that which follows it; and the second is the month preper. Thus in the said year 4024, the expunged month falling on Margasiras (Agrahayan); the notation is Margasiras Paushya: and the latter is the proper current month.

70 When two Tidhis end in a concurrent Solar day, the intermediate Tidhi is expunged out of the column of days in the Kalendar, and it is called a Cshaya Tidhi. The numerical series is therefore interrupted; but the omitted Tidhi, together with its duration, are registered in the margin. Thus we have in the month Cartiga (first Pachum) 11, 12, \*, 14, 15, the 13th being registered out of the line as a Cshaya.

- 80 When no Tidhi begins or ends in a Solar day, the preceding is an Adigah, or intercalary day, and its numeral is repeated. Thus we have in the first Pachum of Vaisacha, 13, 11, \*, 14,
- 90 When a Tidhi is found to begin " before Sun-rise, or at Sun-rise" then it is accounted to belong to its concurrent Solar day.

15. The first Tidhi being accounted the intercalated, and the second the proper one.

- 109 When a Tidhi is found to begin " after Sun-rise," then it is taken to belong to the ensuing Solar day, " provided it does not end in the same day," because in such a case it would fall within the operation of article 70, and would be expunged out of the column of Tidhis.
- 110 If a Tidhi be expunged, it is sometimes called Avamaha, or Oopadi, which means advanced. This circumstance happens on a medium, once in 64 days; so that in one year it recurs five or six times.
- 129 When a Tidhi is repeated twice, it is sometimes called Tridina, or Sprookoo; the most common designations however, are Cshaya for expunged; and Adigah for intercalated.
- 139 In the language of Tellinga Astronomers a Tidhi is a Luni-solar day; and a Theidi, a Solar day; a notation which it is necessary to remember when reading Hindu tracts, to avoid mistakes. Theidi means also a date.
- 149 From the preceding articles it will be easily perceived that the introduction or omission of a Tidhi in the columns of the Kalendar, is purely nominal, which proposition may be illustrated in the following manner.

T. 14th 15th

Two Tidhis ending illa Solir day, the Intermediate a Csha-44.

No Tidhi beginning or ending in the same Solar day an Adigah.

A Tidhi beginning before Sun rise or at Sun rise belongs to the concurrent Solar Cav.

A Tidhi beginning after bun rise belongs to the easuing Solar day.

The intercalary and expurged Tidhis purely nominal.

Let TT' and T'T' represent two Tidhis; and DD', D'D' two concurrent Solar days, then as T (14th) began before Sun-rise, it belongs to the 24th Vyassei (Solar Kalendar); but as T' began after Sun-rise, it belongs not to the 25th, but to the 26th Vyassei (articles 9° and 10°), and so the 25th remains seemingly without an appropriate Tidhi. Hence it comes to pass that the preceding Lunar Tidhi (14th) is supposed to go on until the 26th Vyassei, whose concurrent Tidhi is therefore noted the 15th; and so forth for every possible case.

A constant recollection of this singular disposition, is indispensable to the clear understanding of the manner of registering the days and Tidhis in the Kalendar; and what renders it the more perplexed is, that although the Tidhis are computed according to apparent time, yet they are registered in civil time.

The Tidhis computed according to Sydineal time registered in Civil account.

The precise instant of the day after Sun rise in which the Tidhi ends, is the first article inserted in the margin opposite to it.

#### ARTICLE 2.

Independently of the preceding articles, the Ephemerides which always accompany the Panchangums, exhibit several others, five of which are given for every day, and the rest as there is occasion—the five principal ones are as follows:

Articles of the Ephenierides annoxed to the Panchangum.

1º The Nacshatra in which the Moon is on the given day. 2º The Yogù, which though bearing the same names as the Yoga, has no reference to it, as shall be further explained. 3º The Curna. 4º The Thyagum of the Wurjum, being the unlucky period of the day; the three last being Astrological Elements. 5º The Isharum or places of the Planets in the Lunar mansions on the given day.

I shall only speak of these five articles in this place, because the manner of computing them is given in the third Memoir; but there are eight others which, being purely astronomical or astro-logical, do not belong to our province; and therefore, those who wish for an account of the latter, will find it annexed to the specimen of the Ravi and Chandra Panchangums and Ephemerides inserted at the end of this work.

10 The Nacshatra, or Lunar mansion in which the Moon happens to be on each day.

There are 27 regular mansions in the circumference of the Moon's periodical revolution: each contains therefore 13' 20' of her Zodiac. Sometimes an extraordinary Nacshatra, named Athijit, is inserted between the 21st and 22d, in which case it takes 3' 20' from the former, and 1' 40' from the latter. The Tellinga Astronomers make no use of this extra Nacshatra.

Each mansion is divided into 60 guddias, the guddia into 60 viguddias, &c. so that one guddia is equal to 13' 20", a viguddia to 13" 20", and a para to 13" 20", which denominations must not be confounded with the measure of time of the same names.—The mansion is more

The regular Nac-

The extraordinary Nace latra called Abhijit,

The Nacs, divided into guddias, vigud-dias and paras.

generally divided into four quarters, called Padahs, which are always referred to in the Ephemerides.

The names of the 27 Nacshatras are as follows:

Names of the Nacshatras.

|    | -          |    | U                |    |                   |   |
|----|------------|----|------------------|----|-------------------|---|
| 1  | Aswini     | 11 | Purva Phalguni   | 21 | Uttara A'shad'ha  | ! |
| 2  | Bharanì    | 12 | Uttara Phalguni  | *  | <b>A</b> bhijit   |   |
| 3  | Criticà    | 13 | Hasta            | 22 | Sravana           |   |
| 4  | Rohini     | 14 | Chitra           | 23 | Dhanish'tà        |   |
| 5  | Mrigasiras | 15 | Swa'ti           | 24 | Satabhisha        |   |
| 6  | A'rdrà     | 16 | Visac'ha         | 25 | Purva Bhadrapada  |   |
| 7  | Punai vasu | 17 | Anurádh <b>à</b> | 26 | Uttara Bhadrapada |   |
| 8  | Pushia     | 18 | Jyést'ha         | 27 | Revati            |   |
| 9  | Asleshà    | 19 | Mula             |    |                   |   |
| 10 | Maghà      | 20 | Purva A'shád'hà  |    |                   |   |
|    |            |    |                  |    |                   |   |

In each Nacshatra there is a particular Star called Yoga, which serves as the index of the mansion. The following are their names, with those of the Stars of the European Catalogue which are supposed to be the same as the Yogas (\*)

|     | Yogas.     | Stars of the European Catalogue supposed to be meant. |    | Yogas.          | Stars of the Euro-<br>pean Catalogue sup-<br>posed to be meant. |
|-----|------------|-------------------------------------------------------|----|-----------------|-----------------------------------------------------------------|
| 1   | Vishcambha | γ or β Arietis                                        | 15 | Vajra           | Arcturas                                                        |
| 2   | Príti      | 35 Arietis                                            | 16 | Asrij or Siddhi | 21 Libræ                                                        |
| 3   | Avushmat   | Alcyone                                               | 17 | Vyatipa'ta      | 18 Scorpii                                                      |
| 4   | Saubha'gya | 87 Tauri                                              | 18 | Vari vas        | Antaies                                                         |
| 5   | So'bhana   | cither 113, 116, or 117 Tauri                         | 19 | Parigha         | 34 or 35 Scorpii                                                |
| 6   | Atiganda   | perhaps 133 Tauri                                     | 50 | Siva            | Sagirtarii                                                      |
| 7   | Sucarman   | 3 Geminorum                                           | 21 | Siddha          | P Sagittarii                                                    |
| - 8 | Dhriti     | [δ Cancri                                             | *  | Abhijit         | 2 Lyra                                                          |
| 9   | sila       | 49 or 50 Cancii                                       | 53 | 'Sa'dhya        | Z Aquilæ                                                        |
| 1   | Ganda      | Regulus                                               | 23 | Subha           | a Delphini                                                      |
| 11  |            | perhaps 70 or 71 Leo                                  | 24 | Sucra or Subra  | λ Aquarii                                                       |
|     | 'Dhruva    | 3 Leonis                                              | 25 | Brahman         | e Pegasi                                                        |
| 13  | Vya'gha'ta | 7 or 8 Corvi                                          | 26 | Maha Indra      | γ Pegasi                                                        |
| 14  | Hershana   | Spica Virginis                                        | 27 | Vaidhriti       | ζ Piscium                                                       |

<sup>(\*)</sup> It is foreign to the object of this Paper to enter into an account of the position of these Stars in the heavens: all that I shall observe at this place is, that in taking their Latitude and Longitude out of the Hindu Tables their Fieshipa and Sayana (being corresponding terms), the former is to be considered as an arc of the Meridian which intersects the Star and the Ecliptic, and the latter as the portion of the Ecliptic which is intersected by the same Meridian and the Equinoctial Colure.

20 The Fogl or Foga; which, though bearing the same name, and in the same number The Yogu or Yogs as the Yogu stars exhibited in the preceding catalogue, yet has no Astronomical reference to is, is the time during which the sam of the motions of the Sun and Moon amounts to one Naskatra. Thus if it be found to amount to 10s 10v of a Nacshatra in any Yogu (considered as the first) at 55 50v of time, the following, or second Yoga, will begin at 55 28v after Sun rise the next div. (1)

Of the 27 Yegus, named as the Yogus, of the respective Nacshatias, poventern are nearly Number of Yogus, equal to sixteen days.

So The Carna, or Carana-is the time when the Moon's motion from the Sun amounts to 6°, there being two Caranas in one Tidhi. There are cleven Caranas in all, of which seven are ordinary and moveable, and named Carra: and four extraordinary and fixed, called Schura.

The Curna or Cara.

The ordinary Curnus, or Curunus are specifically named as follows:

Their names.

1. Blása,

5. Yuika or Gurajah,

2. Bhalava,

6. Warnaji,

3. Coulava,

7. Bhudra, or Vusti.

Ordinary,

4. Dhitalà,

The Extraordinaries.

8. Soyami or Chaconi. 9. Chadespadah. 10. Nagava. 11. Cimastughna or Rhimustoguna. Extraordinary.

The first Curna begins when the Moon is 6° from the Sun; and the seven moveable ones being eight times repeated in successive order, include 342° .- The Moon's Synodical orbit being considered as divided into 360°, there remains 18° which she wants to complete her revolution; and these are allotted to the 8th, 9th and 10th Curnas; but the first six degrees after the conjunction belong to the 11th, or last.

Their disposition,

40 The Tyńjyá of the Varjya (pronounced both by the Tamuls and Tellingas Thyajon of the Wurjum) .- These terms are always employed together in the Kalendar, the Varjya being that portion of a Nacshatra which is deemed unlucky, and the Tydjya the time of the duration of the unlucky period. This time is determined by a certain point in each Nacshatra called its Dhruva: that which the Moon's Disc takes, by her absolute motion, to traverse it, is the Ty/jyá; and its mean duration is 4 guddias: but its true one more or less, according as the Moon's continuance in the same Nacshatra happens to be more or less than 60 guddias.

The Tyajya of the Varjya,

What determines the d it mos of the Tya-ىلەر<u>ز</u>

50 The Charum or Padocharum (pronounced Isharum by the Tamul astrologers)-a term used in the Hindu Ephemerider, signifying the daily aspect or position of the planets; answering to .the same signification as Jamna-patriclpha; though the latter means more precisely their aspect at

The Charum or Pad ichai am.

<sup>(\*)</sup> The duration of a mean Yogu is 56g. 20v. 21p.75, but the apparent one varies in preportion with the Bun and Moon's respective apparent motions, which slepends on the place of their Apogees and affords a sust sariety of combinations. Vide page I'4.

any instant of time. The manner of computing these will be found at page 182 of this work. (Vide also Glossary).

Supplementary articles of the Panchangam. It would be a waste of time to enter into any further account of the other Astrological elements which are inserted in the *Chandra Panchangum*, independently of the five preceding ones, such as the *Crantum*, *Vethei*, and *Latta*. Some notice of these, however, will be taken in the IVth Appendix at pages 208 and following.

# ARTICLE 3.

Computation of the mean Elements.

#### DEFINITION.

Definition of the mean Tithi.

Its duration 50g 8v. Sop

That of the true Tit-In variable.

Depend principally on the revolutions of the Moon's Apogee. A mean Tithi or Tidhi, (a Lunar day) is the time during which the Moon moves through 12° of her Synodical orbit supposed to be divided into 360°; its duration is therefore 593 3v 38p Hindu time, or 23h 37′ 27½" European time: of these there are very nearly 371 in a Solar year. (\*) The duration of the True, Sphuta or Sputa Tithi depends on the apparent relative motion of the Sun and Moon. For a very long time the duration of the true Tithi is not sensibly affected by the

Sun and Moon. For a very long time the duration of the true Tithi is not sensibly affected by the motion of the Sun's Apagee: but their longer or shorter duration depends principally on their occurring at the time when the Moon is nearer or further from her Apagee, the former being only of 387 revolutions in a Calpa, and the latter revolving 485203 times in a Maha yug.

# ELEMENTS.

Elements.

The Elements which are required for computing the articles of the Luni-solar Kalendar, are principally as follows:

- 1º The Sun's mean place in the Hindu Ecliptic called Ravi Madhyama Graha.
- 29 The Moon's Do. Madhyama Chandra Graha.
- The place of the Sun's Apogee in Do. called generally his upper Apsis, or Ravi (Tunga) Mandocha.
- 4º The Moon's Do. Chandra Mandocha.
- 50 The Ayanansa, or Ayana Bhagas,—meaning the arc comprised between the Vernal Equinoctial point (Mesha Ayana) and the first in the Hindu Sydercal Ecliptic. This latter Element is required for referring all the computations made on the fixed, or Sydereal, to the moveable, or Tropical Sphere.
- 60 The obliquity of the Ecliptic which the Hindus take to be constantly 21°.

All these Elements are to be resolved by means of the Trin, or Trairás'ica (more generally pronounced Trirasica), the common rule of three; and are therefore, no otherwise difficult to compute than on account of the immense dimensions of the quantities, with which the operations are to be performed. For all these we have the following data.

<sup>(\*)</sup> Tellinga Astronomers allow something more for the length of the mean Tithi, which according to them is of 59g. 5v, 4tp. 23s. Vide page 172.

1º The Sun performs 4320000 Baghanas or Syderent revolutions in a Maha yug; and in the same period of time there are 1577917828 natural or Bhami Savan days.

Data.

Revolutions of the Sun, Meon and their Apogees in a Maha yug or a Calpa.

- 20 The Moon-57753336' in the same period.
- 3º The Sun's upper Apsis—387' in a Calpa or 1000 Maha yug, which Calpa, therefore, contains 1577917828000 Bhumi Savan days.
- 4º The Moon's Apogee-488203' in a Maha yug, with an additive Bijah or correction of 4 revolutions in the same space of time.
- 5º The Ayanas or Equinoctial points, called sometimes Cranti Patas, or Nodes of the Ecliptic—600 Revolutions (or Librations, in whichever way it may please the computer to consider the Hindu precessional variation in a Mahayug.

Of the Equinoctial points.

The revolutions of the Moon's ascending (Rahu the head) and descending Nodes (Keta the tail of the Dragon), which proceed in Antecedentia, are not required for computing the common articles of the Kalendars, being only wanted for Eclipses and Occultations. Of these, however, there are 232238° in a Maha yug, with a Bijah of 4° as for the Moon's Apogee.

These datas are thus presented, on a supposition that the reader is already informed that a Calpa consists of 4320000000 Solar Sydercal revolutions, with a Twilight, or Sandhi of 1728000 years—that this period contains 14 Manwantaras, each of which contains 308448000 years. That a Maha yug is equal to 4320000 years, comprehending four lesser yugs, or periods of conjunctions; viz. The Satya yug 1728000° (equal to the Sandhya which precedes the Calpa)—the Treta yug 1290000°—the Devapar yug 864000°—and the Cali yug 432000°; of the latter of which, in the year of Christ 1822, there were 4923 expired; the 4924th beginning on Thursday the 11th April of the said year, New Style.

The Calpa, Sandhi, Manwantaras, Maha yeg and 4 leaser yugs or periods.

That sort of time which the Hindus call Saura, may be converted into degrees, &c. by the following Table.

Saura time expressed in degrees, &c.

| Handu expression. | Surriah Siddhanta. | Tellinga. | Degrees. | Designation.        |
|-------------------|--------------------|-----------|----------|---------------------|
| A Year            | Sumvat sara        | Mana      | 360,     | 12 Rasis or Signs   |
| Month             | Masha              | Masha     | 30°      | 1 Rasi or 30 Bagahs |
| Day               | Dina               | Theidi    | 1°       | 1 Bugah             |
| Hour              | Danda .            | Guddia    | 1′       | Cala                |
| Minute            | Vicala             | Viguddia  | 1"       | Vicala              |
|                   | Pranacala          |           | 10"      | 1 Pranacala         |
| Second            | Castacala          | Para .    | 1‴       | Castacala           |

The time so expressed, may be converted into Solar Sydereal time by means of Table XVI.

# FIRST OPERATION.

# For the Strostidi Digona.

Strostidi Digona.

The Strostidi Digona means the number of natural days expired from the beginning of the Calpa, or grand Astronomical Epoch when the Planetary motion commenced, to any proposed day. The rule for finding that period of time, though necessarily operose, is easily explained.

### PRECEPT.

Precept.

- 20 Find the number of Saura years expired of the Calpa on that which is proposed, by adding together the Sandhi which precedes the Calpa; six Manwantaras; twenty-seven Maha yugs; the Satya; Treta; and Devapar yugs.—Subtract the number of years employed in the Creation, which is 17064000, and add to the remainder the years of the Cali yug expired: the sum is the Strostidi Digona in Saura years.
  - 2º Multiply the same by 12, and you have it in Saura months.
- 3º There being 1593336 intercalary Lunar months in a Maha yug, find the number due to the Strostidi Digona in months, which add to the former.
  - 40 Multiply the sum by 30, and you have the Lunar days or Tidhis.
- 59. There being 25082252 superabundant, or Cshaya Tidhis, in a Maha yug, find the number due to those found by article 4, which subtract from the same, and the remainder gives the Strostidi Digona in Bhumi Savan days.

Rule.

These five operations are combined in the following Example for the year 1921 current of the Cali yug.

# EXAMPLE I.

| Io, | Sandhi or Twilight of the Calpa Six Manwantaras Twenty-seven Maha yugs The Satya yug equal to the Sandhi The Treta yug The Devapar yug | Sama years.<br>1728000<br>1850688000<br>116640000<br>1728000<br>1296000<br>864000 |
|-----|----------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
|     | Subtract time employed in the Creation Remainder                                                                                       | 19729 14000<br>— 1706 1000<br>— 1955880000<br>— 4923                              |
| 20  | Strostidi Digona in Saura years  Multiply by                                                                                           | 19558849 <b>23</b> × 12                                                           |
|     |                                                                                                                                        | 391176984 <b>6</b><br>195588192 <b>3</b>                                          |
|     | The same in Saura months                                                                                                               | 23470619076                                                                       |

| 30<br>Say  | For the number of Intercalary or Adigah months due to the same period.  As the number of Saura months in a Maha yug  To the number of Adigah months in the same  So the number of months above found  To the number of Adigah months sought  1593333×23470619076  51840000  - add +721384689                                                                     |
|------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| 40         | Number of Lunar months  Multiply by - × 30                                                                                                                                                                                                                                                                                                                       |
|            | Number of Lunar Tidhis 725760112950                                                                                                                                                                                                                                                                                                                              |
| 59.<br>Say | For the number of Superabundant Lunar days, and Strostidi Digona in Bhumi Savan days.  As the number of Tidhis in a Maha yug  To the number of Cshaya Tidhis in the same  So the number of Tidhis above found  To the number of Cshaya Tidhis sought  25082252×725760112950  To the number of Cshaya Tidhis sought  25082252×725760112950  Subtract  11356018175 |
|            | Strostidi Digona in Bhumi Savan days 714404091775                                                                                                                                                                                                                                                                                                                |

# SECOND OPERATION.

For the Soota dina, or feria on which falls the last conjunction of the Luni-solar year 4923 from the Cali yug.

The Strostidi Digona in Bhumi Savan or natural days being divided by 7 7)714404094775(102057727825, weeks

Sonta diva or last day of conjunction.

and the remainder 0 being counted from Saturday as Zero (because the Creation is supposed to have been completed on Sunday) shews that the Luni-solar year 4923 ended on a Saturday, which concurred therefore with the 30th or Amavasya Tidhi of the Lunar month Phalguna of the said year; and shews that the Prathama Tidhi or first day of 4924 fell on a Sunday.

## ARTICLE 4.

Before we proceed any further, we shall consider (with a view to save time) the method according to which Tellinga Astronomers compute the Strostidi Digona in Bhumi Savan days, without undergoing the trouble of the preceding long process.

Tellinga process Strostidi.

Although the Precept disclosed in the 3d Article be the fountain head from which all other methods were derived, yet the extreme length of its operations has tempted modern Tellinga Astronomers to search for shorter Cycles wherein the ratio of the intercalary months and superabandant Tidhis might be preserved, and they have accordingly computed that in 180000 Saura years, there are exactly 66389 Adigah months; and that in 13358334 Lunar months, there are 6270563 Cshaya Tidhis. This Cycle of 180000 affords, therefore, a convenient proposition for computing some of the Elements with perfect accuracy, but from these are to be excepted

the position of the Sun's Apogee, which (as we have already hinted) moves only at the rate of 1' in 517 Saura years, and the precessional variation at that of 54" in a year. These, therefore, require much longer periods, and for this object the following method was found perfectly competent.

### PRECEPT.

Precept,

1e. Compute the Strostidi Digona in Bhumi savan days by the Sastra rule for the end of the last day of the Devapar yug (vide Example I). This will be a constant quantity, to which if you add the Ahargana, or number of natural days expired from the beginning of the Cali yug to the proposed Epoch, you will have the Strostidi Digona for the same, just as if it had been computed by the long process.

# EXAMPLE II.

Rule.

Let the Strostidi Digona for the last day of the Devapar yug be required, for the purpose of deducing therefrom that for the last day of the year 4923 of the Cali yug.

10 Not to repeat what has already been done in the first Example, take the Strostidi in years for the end of the Devapar yug, as found therein; which is 195588000 Saura years: proceed as before, and you will have the same in months 23470560000. Hence for the Adigah months and Cshaya Tidhis.

|                                                   | 23470560000<br>S400000 | Adigal  | h month: | s 7213828<br>234705600 |             |
|---------------------------------------------------|------------------------|---------|----------|------------------------|-------------|
| Number of Lunar months                            |                        | Multip  | oly by   | 2419191287<br>×        | 74<br>30    |
|                                                   |                        |         |          | 7257582869             | 220         |
| and<br><u>25082:52×725758286220</u><br>1603000080 | <b>C</b> shaya         | Tid.    | Sub. —   | 11355989               | 5 <b>93</b> |
| Strestidi Digena in B. S                          | avan D. la             | st of D | evapar   | 7144022960             | 327         |

Now this quantity 714402296627 B. S. days once obtained, becomes a constant number, which combined with the Tellinga rule, will serve in future for finding the Strostidi Digona of all Epochs which do not ascend higher than the beginning of the Cali yug.

Ahargana.

2º For the Ahargana, or time expired from the commencement of the Cali yug to the end of the year 4923.

|     | Number of Lunar men                            | ths soug | ht    | 60891  |
|-----|------------------------------------------------|----------|-------|--------|
|     | Then multiply 4923×12 number of months         | •        | - add | 59076  |
|     | 66389×4923                                     | -        | •     | 1815   |
|     | To the number of Adigah months sought which    | h add    | -     |        |
|     | So the number of years of the Cali yug expired | -        | •     | 4923   |
| •   | To the number of Adigah months in the same     | -        | -     | 66389  |
| Say | As the number of Saura years in the Cycle      | -        | -     | 180000 |

For the superabundant days.

As the number of Lunar months, (see data, page 77) 13358334 To the number of Cshaya Tidhis in the same 6270563 So the number of Lunar months expired 60891 To the number of Cshaya Tidhis sought 6270563 × 60891

28582 13353331

Multiply the number of Lunar months 60891 by 30, it is 1826730

1798148 From which subtracting the Cshaya Tidhis you have

the Ahargana for the end of the year 4923.

3º For the feria of the last conjunction in that Luni-solar year.

Divide the Ahargana by 7)1798148(258342

Soota dina.

with a remainder of which counted from Thursday as Zero (because the Cali yug began on a Friday) gives Saturday, as we found by the Sastra rule.

4º To deduce the Strostidi Digona for the same day from the preceding operations.

| To constant number<br>Add Ahargana | _    | -              | <b></b> | • | <br>B. S. Days.<br>714402_96627<br>1798148 |
|------------------------------------|------|----------------|---------|---|--------------------------------------------|
| Strostidi Digona in B.             | Sava | n day <b>s</b> | -       | - | 714404094775                               |

The same as found by the Sastra rule, the remainder of which, after division by 7, must be counted from Saturday as Zero, as before.

Independently of the method for finding the Ahargana above disclosed, there are shorter Cycles used in Tellingana, one of which will be wanted for resolving the place of the Planets by means of Vavilala Cuchinna's Tables; and a much shorter method will be shewn in a separate Note inserted at the end of the Memoirs, but we shall postpone noticing either until called for, in order not to crowd unnecessarily the matter on the reader's attention.

### ARTICLE 5.

For the Hindu Solar and European dates of the Soota dina or feria of the last conjunction of the year 4923 of the Cali yug.

Hindu Selar and European date of the Souta dina.

Means were given in the first Memoir for finding the European date of any assignable Hindu Solar day; and to these we shall have recourse for finding that of the Amarasya, the Soota dina of which we have computed in the preceding Articles.

The duration of the Solar year according to the Surriah Siddhanta being 365d 15f 31v 31v 24'. multiply the same by 4923, and subtract the Sodhyam (subtractive equation) 2d 85 51' 15', the remainder will be the Solar Ahargana sought. (\*)

Solar Ahargana for Chaitram and preceding month Poor. gom.

<sup>(\*)</sup> The Ahargana may also be obtained with less trouble by means of Table XLVIII part 2d.

| This Element will I               |        |      |   |   |      |       |   |
|-----------------------------------|--------|------|---|---|------|-------|---|
| Neglect the fraction at Article 4 |        |      |   |   |      |       | - |
|                                   | Differ | ексе | _ | _ | 13 ( | ¹avs. |   |

For the juxta position of the beginning of the Solar and Luni-solar years. But by the respective Precepts, the remainder of the Solar Aharrana after division by 7, is to be counted from Friday; and that of the Luni-solar from Thursday, therefore when the Solar is the greatest of the two, one day is to be added to, and when least subtracted from, the difference. In the present case, the interval should therefore be increased by an unit, which makes it 19 days.

Now the remainder of 1798166, after division by 7, being 6, the same being counted from Friday, gives Thursday; and by the rules formerly delivered, will be found to fall on April 11th, A. D. 1822, Sydereal, and (and on account of the fraction 43° 38° 7° 12° which exceeds 50) on the 12th, Civil account. Subtract therefore 19 days from 11th April, and we find Saturday, 23d March N. S. the Sydereal date of the Soota dina sought.

We now want the Civil and Sydereal date in European expression, of the 1st day of the Solar month Poongoni, A. Cal. 4993, for which referring to Table III, we have

| Ahargana 1st Chaifram above found<br>Suntract absolute duration of Poongoni |          | - | - " | <u>-</u> | 1798166<br>30 |     | 3.3 | 7 |
|-----------------------------------------------------------------------------|----------|---|-----|----------|---------------|-----|-----|---|
| M                                                                           |          |   |     |          |               |     |     |   |
| Ahargana 1st Poongoni A. C. 4923                                            | <b>~</b> | - | -   | •        | 1798136       | -23 | 17  | 5 |

and the sum of days after division by 7, leaving a remainder of 4 to be counted from Friday, indicates Tuesday the Soota dina sought.

Using, therefore, any Kalendar, and counting 50 days backwards from the 11th April, we find Tuesday the 12th March inclusive, (the 11th being the last day expired), which is the St dereal date of the 1st Poongoni European account.

Again, the fraction 23° 17° 5° (below 30) shews that on the beginning of that month the Sydereal and Civil account coincided, and since the 1st Poongoni fell on the 12th March inclusive, and the Luni-solar Scota dina on the 23d, it follows that the Solar date sought is the 12th Poongoni, and that the Sydereal and Civil account coincide; altho' on account of the fraction of the Solar Ahargana for 1st Chaitram 4924; 43° 37° 57° (above 30) the Sydereal month is of 30, the Civil is of 31 days.

The date of the last Amavasya, 30th Phalguna of the year 4023, is therefore, Saturday the 12th; and that of the Prathama Tidhi, the 1st of the Lunar month Chaitra 4921, Sunday the 13th Poongoni of the Solar year 4923.

The following Elements are, therefore, all computed for the 12th Poongoni.

N. B.—A difference will be found between these results, and those which would be obtained if the Elements of the Ariah Siddhanta (those of the Solar Kalendar) were to be used; for the

We have thus been obliged to suspend the computation of the mean Elements, from the necessity of fixing the date of the Luni-solar Soota dina according to the Solar Kalendars, without which it would be impossible to determine the circumstance of the intercalary and expunged Tidhis, in the Chandra Panchangum. We shall now resume it in the following Article.

#### ARTICLE 6.

# THIRD OPERATION.

For the Ravi Madhyama Graha or mean place of the Sun in the Hindu Zodiac.

### FOURTH OPERATION.

For the Chandra Madhyama Gral.a, or mean place of the Moon

| in Do. 57753386×71'40'69'775 | • | - | 11 5 | 21 | 15 | 34 | 21 |
|------------------------------|---|---|------|----|----|----|----|
|------------------------------|---|---|------|----|----|----|----|

## FIFTH OPERATION.

For the place of the Ravi Tunga Mandocha, or Sun's Apogee

| in Do.   | 397×711161691775 | • | - | 2 17 17 17 54 |
|----------|------------------|---|---|---------------|
| a Calpa. |                  |   |   |               |

<sup>(\*)</sup> The form in which I present these expressions has been objected to as unauthorized by custom, for generally a quantity placed on the right side of an Lquation of this sort, implies a remainder; but a different disposition of the figures would have perplexed the reader's eye, and the results when referred to are more readily found when classed in order after the expressions. Mr. Samuel Davis has followed the same notation without its being objected to in Europe, I rely on the same indulgence.

# SIXTH OPERATION.

For the place of the Chandra Mandocha or Moon's Apogee in Do.

|                                              |           |                  |      |       |      |             | • | •  | ,          |    | •  |
|----------------------------------------------|-----------|------------------|------|-------|------|-------------|---|----|------------|----|----|
| 489903×71440409477                           | 15        | *                |      | -     |      | •           | 7 | 2  | 57         | 26 | 12 |
| Correction of Bijah                          |           |                  |      |       |      |             |   |    |            |    |    |
| 4×714404094775<br>1577917828                 | -         | -                |      | -     | •    | dd          | 0 | 1  | <b>3</b> 8 | 27 | 10 |
|                                              |           |                  |      |       |      | •           | 7 | 4  | 35         | 53 | 22 |
| Sev                                          | енти Оги  | RA'              | rio: | N.    |      |             |   |    |            |    |    |
| For the Ayan                                 | ansa or A | lya <del>r</del> | ıa I | Bagi  | ahs. | <b>(*</b> ) |   |    |            |    |    |
|                                              | Revoluti  | ions             | i.   | Par   | ts.  |             | • | •  | ,          |    | -  |
| $\frac{600 \times 714404054775}{1577917828}$ | (2716.    | 50)              | 6    | 837   | 42   | or          | 8 | 6  | 8          | 4  | £T |
| 3077677020                                   |           | •                | •    | ,     |      | -           |   |    |            |    |    |
|                                              | and<br>—  | 8<br>6           | 6    | 8     | 4    | 5 <b>7</b>  |   |    |            |    |    |
| •                                            |           | 2                | 6    | 8     | 4    | 57          |   |    |            |    |    |
|                                              |           |                  |      |       | >    | 3           |   |    |            |    |    |
|                                              | 1         | 0)6              | 18   | 21    | 14   | 51(         | 0 | 19 | 50         | 25 | 29 |
| Ayanansa on the 12th of Poongon              | i of the  | Sola             | r w  | ogr / | 100  | 2           |   |    |            |    |    |

The Ayanansa on the 12th of Poongoni of the Solar year 4923 of the Cali yug, being the day of last Amavasya (conjunction) of the Luni-solar year of the same denomination, is therefore 0 19 50 25 29

From the above passages the modern Hindu Sastras (and Mr. Davis after them) conclude, that the Equinoctial points are considered in the Surriah Siddhanta, as librating from the 3d degree of Min &, to the 27th of Mesha Y;

<sup>(\*)</sup> I cannot dismiss the operation for finding the Ayanansa, the most important Element of Hindu Astronomy, in as much as it is the Equation which transfers all the computations made on the Sydereal, to the Tropical Sphere, without offering a few words on the formula used in the text, and the view which modern European Scholiusts have taken of the theory of that Element, in which some differ very materially. All that the Surriah Siddhanta says on the Ayanansa, is comprised in the following few lines, in reporting which I use Mr. Davis's version.

<sup>&</sup>quot; The Ayanansa moves Eastward thirty times twenty in each Maha yug. By that number (600) multiply the " Ahargana, and divide the product by the number of Savan days in a yug, and of the quotient take the Bhuja 44 (supplement to or excess over 180°), which multiply by 3, and divide the product by 10; the quotient is the

<sup>44</sup> Ayanansa. With the Ayanansa correct the Graha, Cranti, the Ch'haya, Charadala and other requisites to find 44 the Pushti and the two Vishuvas.

<sup>&</sup>quot; When the Curna (Hy pothenuse) is zess than the Surriah Cl. kya (the Gnomonic Shadow of the Sun) the Prac-

<sup>&</sup>quot; Chacra, moves Eastward, and the Ayanansa must be added; and when MORE, it moves Westward, and the " Ayanansa must be subtracted."

The commentary goes on to say, "that if the Sun's true place (Sputa Graha) computed by the Ahargana, be " less than that found by his Gnomonic Shadow, the Ayanansa must be added (and vice versa). In present times 46 (adds the Tika) the Ayanansa is added."

Norz.—Since the Equinoctial points complete their revolutions 200 doines in a Wishe guy, and during each, pass through a space equal to four times 27', or 196' of the Millotic, which is 3-19ths of 360', (its whole circumference) the remainder, of the preceding operation, after subtracting the Bhuja, is drawn into  $\frac{1}{10}$ . Now for the annual variation, we have according to former Frecepts  $\frac{1}{43}\frac{5000}{2500}\frac{1}{2500}\frac{1}{2500}$  revolutions, equal to 54" exactly. Hence, for finding the Aya. nansa at any particular time, the Sastra rule may be dispensed with; for it needs only be remembered that the fixed and moveable Solar Zodiac, are supposed to have been coincident at the expiration of the 3660th year of the Cali yug; and that the Equinoctial points have a retrograde motion of 54" in a Sydereal year. Therefore, to find the Ayanansa for the end of the Solar year of the Cali yug 4023, we have 4923-3600-1323, and 1023×54"=19° 50' 42".—This result differs from that found by the 7th Operation by 17" 31", but the latter was for the end of the Luni-solar and not the Solar year 4923, which began 19 days later. True it is, that this difference accounts only for 2",8; but the Tellinga Astronomers are contented to use the Druva or Epoch of the year 3600 of the Cali yug for common computations, because they generally neglect the seconds. One thing is certain, however, which is, that if at the end of the sold Solar Sydereal year there was truly no Ayanansa (as they suppose), their method is more secure than that of the Sastras. The Table XXXV of this collection has been constructed with reference to the Druva.

For the period in time of the revolution of the Ayanas we shall observe, that as there are 600 Baghanas (for so they are called in the Varasanhita) in a Maha yug and of Saura years in the same period 4320000, it follows that one Baghana of the Ayanausa is equal to 7200 years. The Hindus divide that period into four quarters, called Padahs, during the first and fourth of which

and from the 3d degree of Canya M, to the 27th of Tula 2, of the fixed Indian Ecliptic; for it must not be imagined that this conclusion originated with the gentleman above quoted; the same having been distinctly explained to me in Madras by the College Sastra (an able and aged Native Astronomer) in the year 1814, which is more than 25 years after Mr. Davis had written his tract.

The exact meaning of the word Prac Chacra used in the Sungscrete text, is not sufficiently known to me to draw any satisfactory conclusion therefrom; but the term Chacra clearly means a wheel or circle, and if in the present case it may be taken in the sense of an Epicycle, it would not be a forced inference to consider it as one of a Radius equal to 27° of the Deferent, whose center would lie at the Equinoctial point, revolving on itself, and through which the line of Rishis (that which is supposed to pass through the center of the great Orb, and to be directed towards certain Stars of the great Bear; and at which the four fixed and moveable Solar and Lunar Zadices coincide after certain revolutions of time) should pass, in the plane of the Ecliptic. If such a scheme could be admitted, it would not be difficult to comprehend how a point in the Axis of the moveable Orbit, revolving in the Epicycle and proceeding from the point of coincidence towards the East, might after 1800 years (one Padah, or quarter of the Ayanarsa) reach its greatest Eastern Elongation, equal to 27° of the Deferent, then seem to move during 1800 years more in antecedentia, after which it would again fall in the line of the Richis, in a point of superior conjunction when the Ayanarsa would again be equal to Zero; from which, after passing through its greatest Western Elongation, it would proceed in consequentia, and in a complete period of 4×1800, or

the Cranti-Pata Gati is additive, and consequently the Ayanansa is increasing, and during the second and third decreasing.

The obliquity of the Ecliptic is supposed to be constantly 24°; and it must be a matter of astonishment to perceive, that these who were able to discover (though imperfectly) the precessional variation, should not have even suspected the diminution of the former.

There remains now to explain the word Bhuja, which was used for the first time in the last Operation; but of which we shall make frequent use in the sequel.

The Bhuja is always understood to be the supplement of an arc of 6 or 12 signs, or the difference above 6 signs, and below 12 signs, if the arc exceeds 6 or 9 signs; thus:

- 1. If the arc exceeds 3 signs Subtract from 6 signs.
- 2. If it exceeds 6 signs Retrench 6 signs from the arc.
- 3. If it exceeds 9 signs - Subtract the arc from 12 signs.

All Hindu Tables and Rules are adapted to these Rules.

The mean Elements being thus computed, they are, when collected in one view for reference, as follows:

| • |                |                   |      |       |      |   | •  | •  | ,  | "  | 41  |
|---|----------------|-------------------|------|-------|------|---|----|----|----|----|-----|
|   | Sun's mean pla | ace 12th <b>I</b> | oons | oni 4 | 1923 | - | 11 | 9  | 26 | 36 | 37  |
|   | Moon's Do.     | Do.               | -    | -     | •    | - | 11 | 21 | 15 | 34 | 24  |
|   | Sun's Apogee   | Do.               |      | -     | -    | - | 2  | 17 | 17 | 17 | 5 1 |
|   | Moon's Do.     | Do.               |      | -     | •    | - | 7  | 4  | 35 | 53 | 22  |
|   | Ayanansa       | Do.               |      | -     | •    | • | 0  | 19 | 50 | 25 | 29  |
|   | Obliquity of t | the Eclipti       | c    | •     | ~    | - | O  | 24 | 0  | 0  | 0   |
|   |                |                   |      |       |      |   |    |    |    |    |     |

We shall now pass to the computation of the true, or Sputa Elements.

7200 years from the outset, and after having revolved through an arc equal to 168 degrees of the Deferent (360 of the Epicycle) return to its original point of coincidence.

A similar notion occurred to the Arabian Astronomer Tebith-Ben-Chora in the IXth century, when he attempted to account for the change in the obliquity of the Ecliptic (unknown to the Indians, who always take it to be 21°) and the inequality of the precessional variation. He supposed an Epicycle at the Equinoctial point and found with reference to it that the Stars sometimes appeared to move towards the East and at others towards the West, with unequal velocities; that doctrine was victoriously combated by Rheinholdus and Regiomontanus; nevertheless, by an hypothesis much ressembling it, it so happens that the small quantities of the Rutation of the Earth's Axis, have been resolved by our own Astronomers during the last century.

But what leads me to abandon this hypothesis, is, that I perceive no where in the Hindu doctrines, any trace of a variable motion in the Equinoctial points, which, whether the Cranti-Pata Gati (literally the motion of the Nodes of the Ecliptic) be considered as a libration or a revolution, should be felt particularly, either at the limits, or the Eastern and Western Elongations; such a notion being especially inseparable from that of an Epicycle. Nor can it be ascribed to ignorance on the part of the Hindus, who have shewn themselves to be fully aware of the effect above adverted to in their theory of the Anomalistic Equation, where they increase or decrease the Radius of their Epicycle, as it is supposed to approach or recede from the Sizigies, and take their Paridhi-ansas (Epicycular degrees) equal to Zero, between Sama and Vishuma (odd and even), i.e. at 3 and 9 signs Anomaly.

#### ARTICLE 7.

For the true Elements and the Amavasya and Prathama Tilhi of the year Cali yug 4923.

In eliciting the true Elements I shall follow the course of the Southern Hindu Astronomers in their various contrivances for saving as much labour as possible, consistently with correct deductions. Several of these methods are new to Europeans.

## EIGHTH OPERATION.

For the Sun's true place in the Hindu Sodiac, or Sputa Graha.

|                            |         |         |    | •      | •   | ,  | 11   |
|----------------------------|---------|---------|----|--------|-----|----|------|
| Subtract the O's Madhyama  | i Graha |         | •  | 11     | 9   | 26 | 37   |
| From the place of his Apog | ee (Ma  | ndocha) | -  | 2      | 17  | 17 | 18   |
| Manda Kendra or Argumen    | t of A  | nomaly, | _  | 3      | 7   | 50 | 41   |
| From which subtract        | -       | -       | -  | 6      | 0   | 0  | 0    |
| Bhujsh or supplement       | -       | 2       | -  | 2      | 22  | [9 | 19   |
|                            |         |         | or | S2' 9' | 19° | == | 559" |

With 82° refer to Maracanda Anomalistic Table (Ravi P'hala, Table XXV.)

Say 60: 559:: 18:  $\frac{559 \times 18}{60} = 2$  47

which last fractional part 472 exceeding 30", merge into the vicalas and take 3.

| Equation for 82°   | -           | -       | - | - | 2 | 9 | 18 |
|--------------------|-------------|---------|---|---|---|---|----|
| Fractional part    | -           | •       |   | - |   |   | 3  |
| Manda P'hala er An | omalistic E | quation | - | • | 2 | 9 | 21 |

Now this Equation (\*) being additive for midnight, the apparent time, or instant of the Sun being actually on the other Meridian, must be somewhat later than the mean time of midnight, or when his mean place answers to the Meridian. The Equation due thereto (which always depends on the Sun's Anomalistic Equation) is what the Hindus call Arca-Bahoota Sumscara, or Arca Bhagabala: for the correct resolution of which

The Sun's true place.

Arca-Pahoota Sumscara or Bhaga bald.

<sup>(\*)</sup> Mr. Davis having demonstrated that Maracanda's Tables were constructed by help of the Trigonometrical Tables of which he has investigated the theory, it would be useless for me to prolong this paper by using the Pindas instead of the Equations. Those, however, who may be desirous to practise the long process, will find in Table XXXI a canon of sines, cosines, and versed sines, which has not yet appeared in print.

| Say 350° the revolution through the 6<br>59′ 8″ Sun's mean motion in 1 d<br>So Equation due to 82° (2° 5′ 21 | ny     | Circ  | ele or          | 3          | 000 <b>*</b><br>5 <b>!S</b><br>75 <b>3</b> |
|--------------------------------------------------------------------------------------------------------------|--------|-------|-----------------|------------|--------------------------------------------|
| 3543×7758 = 21" The Arca Eli                                                                                 | ngábal | a. (* | 7)              |            |                                            |
| Son's mean Longitude Manda P'hala Area Bhagátala                                                             | • -    | 11'   | 9 <b>°</b><br>2 | 54,<br>54, | 37#<br>21<br>21                            |
| Sun's Sputa Grains, or time place                                                                            | for    |       |                 |            |                                            |
| apparent midnight at Lanca                                                                                   | -      | 11    | 11              | 36         | 19                                         |

## NINTH OPERATION.

For the Sun's true motion or Sputa Gati.

The Sun's true motion.

The Sun's mean motion in one day being 59eal 8vic, with the Bhujah of Manda Kendra found XXIV before 82° 9' 17" (6th Operation), referring to Table #, in the column of difference from mean to true motion, you find 18'; and as the difference for one degree is only 3", the quantity due to 19' 17" may be neglected.

| Table I. | ⊙'s mean motion in one day   |   | • | •  | 59′ 8″<br><del> -</del> 18 |
|----------|------------------------------|---|---|----|----------------------------|
| _        |                              |   |   |    |                            |
| Sun'     | s Sputa Gati 12th Poongeni 💎 | • | • | ** | 59 28                      |

# TENTH OPERATION.

For the Moon's true place, or Spata Graha.

The Moon's true place,

| From the place of the Moon's Apogee Subtract her Machyama Graha | - |                 | 35/<br>15 | ****           |
|-----------------------------------------------------------------|---|-----------------|-----------|----------------|
| Chandra Manda Kendra or Argument of Anoma'y From which retrench |   |                 | 20<br>0   |                |
| Bhujah, or distance from Perigee                                |   |                 | [20<br>20 | 19<br>19=1219" |
| , , , , , , , , , , , , , , , , , , , ,                         |   | 44 <del>-</del> |           |                |
|                                                                 |   |                 | <br>      | 28= 208'       |

Then say: 60: 208'' :: 1219'' :  $\frac{208'' \times 1219}{60} = 1' \cdot 10'' \cdot 25''$  and for second difference

: 360°: 208":: 3° 27′ 26": 208"×12446 =19 vicalas.

<sup>(\*)</sup> In order to save the trouble of these computations, the Hindus generally take the Sun's Arca Bhaga'hala to be the 355th part of its Anomalistic Equation: thus  $\frac{2.9.21}{555} = 21''$ , and the Moon's  $\frac{2.9.21}{27} = 4'47'$ , difference 4''.

| Hence, Equation for 43°        | 1st<br>2d | Equation do.  | • | • | 3° | 27'<br>1 | 26*<br>10<br>19 |  |
|--------------------------------|-----------|---------------|---|---|----|----------|-----------------|--|
| Manda P'hala or Anomalistic Eq | uatior    | ı subtractive | _ |   | 3  | 23       | 55 <del>~</del> |  |

For the Arca Bhagábala or Equation of the Moon's place from mean to true midnight, say: as 360°: to 2° 9′ 21″ (Sun's Manda P'hala, 8th Operation):: 13° 10′ 35″ (Moon's mean motion in one day, 11th Operation):

: 2-5' ×13' ×13' 10' S5" 4' 43" the Arca Bahoota Sumscara, depending on the Sun's Anomalistic

Equation, from mean to true midnight on the 12th of Poongoni, additive.

Thus we have

#### ELEVENTH OPERATION.

For the Moon's true motion or Sputa Gati.

The Moon's mean motion in one day is 13' 10' 35"; and her distance from Perigee is 1' 13' The Moon's true motion.

20' 19" (10th Operation) or 43' [26' 15".

With 43° referring to Table XXV , you find

Then say:  $60': 20' \cdot 19'': 62'': \frac{62''}{50} = 30'' \cdot 39'' \text{ or } 31''.$ 

| We have therefore | D's mean | motion ir | one d | lay | - |   | 13* |    | 35 |
|-------------------|----------|-----------|-------|-----|---|---|-----|----|----|
| Equation for 43°  | •        | -         | -     |     | - | _ |     | 50 | 48 |
| Proportional part | -        | -         |       | •   |   | • |     |    | 31 |

Moon's Sputa Gati or true motion on the 12th of Poongoni . 14 1 54

TWFLFTH OPERATION.

For the true distance and relative motion or Vi-Arca Indoo Graha and Gati.

| ©'s ! | Sputa | Graha | - | - |   | - |   | - | 11" | 11° | 36′ | 19* |
|-------|-------|-------|---|---|---|---|---|---|-----|-----|-----|-----|
| D's   | Do.   | Do.   | • | • | • |   | - | - | 11  | 17  | 51  | 22  |

Scob-vi-Arca Indeo Graha, or distance at midnight - 6 15 3 the Moon having passed the Sun.

True distance and relative motion.

|                   |           |              |        |   |    | •  |     |
|-------------------|-----------|--------------|--------|---|----|----|-----|
| O's Sputa Gati    | 7         | •            | •      | - |    | 59 | 26  |
| D's Do. Do.       | •         | •            | •      | • | 11 | 1  | 5 1 |
|                   |           |              |        |   |    |    |     |
| Soob-vi-Arca Indo | o Gati, o | r relative r | notion | • | 13 | 2  | 28  |

which relative motion is the Element of the Sputa Tidhi; or true Luni-solar day due to the 12th Poongoni 4923.

### THIRTRENTH OPERATION.

For the time due to distance or instant of Arca-Indoo Sangama.

Arca-Indoo Sangama, or Durcain. True conjunction. The true distance of Sun and Moon at midnight of the 12th of Poongoni complete, or 13th commencing, according to astronomical reckoning was (preceding article) 6° 15′ 3″, and the relative motion 13° 2′ 28″, say therefore: 13° 2′ 28″: 60°:: 6° 15′ 3″:  $\frac{60 \times 5^{\circ}}{13^{\circ}} \frac{15' 3''}{2 \times 25} =$ The time sought = 28° 45° 32°.

But the Moon had passed the Sun when it was true midnight at Lanca, and the notation of the Tidhi requires the knowledge of its juxta position to Sun rise (Art. 2, paras. 9, 10 and 14'; therefore to express the time of conjunction in Solar time where midnight falls on the 45th guddia,

True Amavasya after Sun rise of the 12th Poongoni current - 16 14 28 which marks the instant when the last or Pavarnami Tidhi of the Luni-solar month Phalguna ended, and the Prathama Tidhi of the ensuing Chaitra began.

Notation of the Tidhi in the Panchangum.

Notation of the Tidhi in the Panchangua.

We have seen, Article 2, para. 10, page 72, that if a Tidhi happens to commence after Sun rise it is accounted to belong, not to its proper concurrent Solar day, but to the following one; therefore, although the present Tidhi was almost entirely spent in the 12th of Poongoni, yet it is to be coupled with the 13th, and so it will be found in the Patra for the Luni-solar year Cali yugam 4923, because the Solar mouth Poongoni having begun before Sun set, i. e. at 23' 17' 4° (vide Kalendar) the Civil and Sydereal accounts coincide during the whole month.

#### ARTICLE 8.

## Hindu Gnomonics.

All the foregoing resolutions are confined to the Geographical position of Lanca, which is supposed to have neither Latitude nor Longitude, a primary process which in all cases is indispensable when using the Rules of the Surriah Siddhanta. The object of the present article is, to shew what those results would be at any other place not under the Equator and first Meridian; and for this purpose the Hindus have recourse to the Tropical or moveable Sphere, supposed by some to be that of their primitive Astronomy.

Considering of what importance the theory of Gnomonics is to Hindu Astronomy, it is surprising that so little should have been written upon it by European commentators; for although Mr. Davis has resolved some of its Problems with his usual sagacity, yet he has gone no farther than his own immediate purposes required. In order to fill this chasm in our present stock of information, I have collected in this article every case that appeared to me of importance; but if I have omitted any, the ingenious reader will easily supply the deficiency, by drawing Corollaries from those expounded in the Examples.

Although the present article professes to treat only of Gnomonics, yet I have found it expedient, for the sake of arrangement and expedition, to dispose along with what strictly relates thereto, of those Problems to which Gnomonics are auxiliaries.

The theory of these Problems rests of course, on Plane and Spherical Trigonometry, and every case expounded in the following pages is exclusively resolved on Hindu principles, and by help of Tables of their own, the formulæ of which will be found annexed to Table XXX of this collection.

An account of the terms used in Hindu Tropical Astronomy and Gnomonics being indispensable, the names of the principal Elements are defined and explained in the following list.

#### DEFINITIONS.

Sanku, or Sunka-The Gnomon.

Ch'hya or Chaya\_Its Shadow.

Palabah, or Vishama Chaya...The Shadow of the Gnomon at mid-day, when the Sun is in the Equinoctial points.

Vishama Carna\_The Hypothenuse of a right angled triangle formed by the Sanku and the two sides of its Shadow under the preceding circumstances.

Madhyama Chaya...The mid-day Shadow at any other time of the year.

Sama-Mandala-Chaya-The Shadow when the Sun is East or West of the Gnomon.

Cranti Mandala\_The Ecliptic.

Cranti Bagahs-The declination of a point of the Ecliptic.

Nari-Mandala-The Equator.

Sayana-Celestial Longitude considered in the same manner as that of the Europeans.

Vicshipa-Celestial Latitude.

Seva-desa-Paridhi-A circle of Longitude in any given Latitude,

Agra-The Amplitude.

Natansa, or Nata Bagha-Zenith distance.

Cshetija-The Horizon.

Lagna...The Arc of the Equator which passes over the Meridian in the same time with each Sign of the Ecliptic.

Madhyama Lagna Mean Do. that of Lanca, the same Arc which rises above the horizon with each Sign of the Ecliptic.

Ullagna—The Lagna of any particular place, being the Arc of the Equator which rises above the horizon of that place, in the same time that each Sign of the Ecliptic rises.

Dinarda-Half the day.

Ratri Arda-Half the night.

Jya or Jaya-When connected with the name of any Element means its Sine.

Paramapa. Cramajaya... The Sine of the greatest declination of a Planet. As the Hindus take the obliquity of the Ecliptic to be constantly 24, the above term when referred to the Sun, means the Sine of the obliquity.

# SECTION I.

Description of the Sanku or Gnomon,

The Sanku is a strait Rod, Pole or Pillar of Stone, such as we invariably see placed in front of every Pagoda in India, placed perpendicularly on an horizontal plane. The Hindus trace a Meridional line by describing concentric circles from the point on which the center of the Pillar is to rest on the ground, precisely in the same manner as Europeans do.

Its construction.

Divisions.

Whatever be its height, the Sanku is divided into 12 angulas, or digits, and each angula is subdivided into 60 vinculas. It thus serves as a scale for measuring the Ch'hya or Chaya, the length of the Meridional shadow; and a Rod is accordingly made of the same dimensions and divisions for that purpose.

In marking alternately the points where the top of the shadow cuts any of the concentric circles, they chuse the time of 5, 6 and 7 dandas (or Indian hours of the murta account 60 to a day) before and after noon: This being done the arcs are bissected; the Meridian line is traced, and the four Dikas, or cardinal points; with the Asta Dikas, the four intermediate divisions are easily determined.

Dimensions of the Equatorial circle, and parallels of Latitude, Before entering into the resolution of the Problems which depend on the length of the Meridian shadow, it is proper to enquire how the Hindus compute the dimensions of the Equatorial circle, and thence those of the parallels of Latitude of any given place.

Ratio of the diameter to the circumference, Of their manner of resolving geometrically the ratio of the diameter to the circumference of a circle, I never saw any Indian demonstration: the common opinion, however is, that they approximate it in the manner of the ancients, by exhaustion; that is, by means of inscribed and circumscribed Polygons. However, a Native Astronomer who was a perfect stranger to European

Geometry, gave me the well known series  $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} + \frac{1}{15}$  &c. to unit (\*) being the ratio of the area of the Circle to the square of its diameter, or that of an Arc of  $45^{\circ}$  to Radius unit,—and  $4 \times (1 - \frac{1}{3} + \frac{1}{5})$  &c.) equal to the circumference, the diameter being 1. This person reduced the five first terms of the series before me, which he called Bagah-Anoobanda, or Bagah Apovacha; to shew that he understood its use. This proves at least, that the Hindus are not ignorant of the doctrine of series; but I could not understand whether he pretended to make out his ratio of the Earth's diameter 1600 to Equatorial Circle 5059 (that which he used in all his computations) by means of these expressions.

Be this as it may, it is certain that according to their Trigonometrical Tables, the Radius, or Sine of 90° being equal to 57° 18′ (†), the diameter would be to the circumference as 1:3,14136, &c. (‡) so that dividing the diameter of the Earth into 1600 yojanas, it would give the Equatorial Circle 5026,176 yojanas. But it is somewhat singular to observe, that they should have preferred for constant use another ratio much less accurate, by their own account.

Dividing the diameter, as before stated, into 1600 parts, and multiplying the square of that number by 10, the root of the product  $\sqrt{10\times1600}$  5059,6 yojanas gives the dimensions of the Equatorial Circle. Or taking the ratio as  $1:\sqrt{10}$ , otherwise 1:3.1619, &c. they have the same 5059,04 yojanas.—In all calculations of the Hindus that I have seen, they content themselves with using 505930, which is somewhat nearer to their Tabular ratio: but in the following calculations I have used the mean or 5059,3, which difference, however, is of little importance, considering the means that are used for determining the Palabah, the principal Element.

Sometimes when the Almanac makers pretend to be very accurate, they divide the diameter into 20,000 parts, and then using the above formula  $\sqrt{10\times20,000}$  they have 62832y for the

Practical Rule for finding the dimensions of the Equatorial Circle in yojanas.

Quantity used 5059 3 yojanas.

<sup>(\*)</sup> I owe the following note to Mr. Hync's favour. "The Hindus never invented this series; it was communicated with many others, by Europeans, to some learned Natives in modern times. Mr. Whish sent a list of the various methods of demonstrating the ratio of the diameter and circumference of a Circle employed by the Hindus to the Literary Society, being impressed with the notion that they were the inventors. I requested him to make further inquiries, and his reply was, that he had reasons to believe them entirely modern and derived from Europeans, observing that not one of those who used the Rules could demonstrate them. Indeed the pretensions of the Hindus to such a knowledge of Geometry, is too ridiculous to deserve refutation." I join in substance in Mr. Hyne's opinion, but do not admit that the circumstance that none of the Sastras mentioned by Mr. Whish, who used these series could demonstrate them, would alone be conclusive. It cannot certainly be denied, that the inventors of the system of Hindu Astronomy possessed a knowledge of Geometry which their successors have not currely preserved, and if we bring the question home to ourselves we are compelled to acknowledge, that thousands (even among the well informed) use La Place's formulæ without understanding the principles of their construction.

<sup>(+)</sup> The European Arc is =57° 14' 21",8,

<sup>(‡)</sup> Do. as 1 : 3 14159 &c.

dimensions of the Equatorial Circle: but all they gain is, that they exhibit the same ratio into minuter parts, without any nearer approach to truth.



## PROBLEM I.

Let SC be the height of the Gnomon, divided into 12 angulas, or 12×30=720 vinculas; CP the Palabah, or mid-day shadow at the Equinox. SP the Vishama Carna, or Hypothenuse of the Gnomonic shadow on the same day; and ∠CSP be the Polar Altitude; which in the present case let it be 13°4′ N. Say:

| As Cosine Polar Altitude CSP               | - | • | • | -  | <b>3</b> 543′                |  |
|--------------------------------------------|---|---|---|----|------------------------------|--|
| To Sine of the same                        | • |   | • | •  | 7761,2                       |  |
| So height of the Eanku SC                  | - | - | • | •  | 720 vinculas.                |  |
| To $\frac{776' \times \times 720}{3348} =$ | - | - | • | 16 | 66,8 <u>-2</u> wr. 46,8 vin. |  |

the length of the Palabah, or Equinoctial shadow at Madras: a constant quantity for that place.

Q. E. In.

The Acsha Bagahs or Latitude,

Palitah.

S0°

# PROBLEM II.

Given the Palabah or Vishama Chya (above found) - Angulas. Vinculas. 46,8

Wanted the Acsha Bagahs, or the Altitude of the Pole?

#### A

To determine the length of the Vishama Carna, or Hypothenuse SP, the angle at C being a right one, we have

|                        | $\sqrt{720 + 2.46,8}$            | <b>==</b> • |   | Angulas. Vinculas, 12 9 |
|------------------------|----------------------------------|-------------|---|-------------------------|
|                        | В                                |             |   |                         |
| Then: As Vishama Carna | * *                              | Ž.          | à | 12 9                    |
| To Palabah             | •                                | •           | - | 2 46,8                  |
| So Radius              | • •                              | y .         | • | <b>3</b> 438′           |
| To                     | $\frac{12.46,9\times3438}{12.9}$ | , .         | • | 776′                    |

the Sine of the Acsha Bagahs, the same as found by the Tables in the preceding Example, whose Arc is 13° 4'.

#### COROLLARY.

Should the Altitude of the Equator or angle CPS be required, the proportion would be, As Vishama Carna SP, to height of Sanku SC, so Radius, to Lumbajaya; properly the Cosine of the Latitude of a place, but called in this place the Sine of the Altitude of the Equator, which using the same quantities as above, would be 76° 56'.

## PROBLEM III.

| Given the Altitude of the Pole             | •             | -           | -        |            | 13° 4′             | 2 |
|--------------------------------------------|---------------|-------------|----------|------------|--------------------|---|
| Whose Cosine is (Prob. I.)                 | -             | -           |          | •          | 3348'              | 1 |
| The circumference of the Equator           | rial Circle ( | (page 93)   | -        | -          | 5059,3 yojanas.    | • |
| Wanted the Parallel Circle of Longitu      | de due to ti  | ie above I  | atitude  | (that of   | Madras). Say       |   |
| As Radius                                  |               | -           | -        | •          | 3439'              |   |
| Cosine Latitude                            | -             |             |          | -          | 3348′              |   |
| So circumference of the Equatori           | al Circle     | ~           |          | •          | 5059,3 yo.         |   |
| To $= \frac{3348' \times 5059 \ 3}{3195'}$ |               |             | -        | -          | 4925,9 yo.         |   |
| The Seva-desa-Paridhi, or circumfer        | ence of the   | Circle of 1 | Longitud | e in the l | Latitude of Madras |   |

(that entered in Table XXXIV.) (\*) Q. E. In.

# PROBLEM IV.

Given the circumference of the Circle of Longitude in the proposed Latitude (Prob. III.) 4925.9 The distance in degrees of the given place Last or West from the first Meridian 4° 35′ E. which in the present case let it be the Desentara of Madias. Wanted the Longitude in time and yojanas.

Say: as  $360^{\circ}$ : 5059,3::  $4^{\circ}$   $35^{\circ}$ :  $\frac{5059,3 \times 4^{\circ}}{360^{\circ}} = 64,4$  yojanas.

N. B.—At Madras the Hindus take this assignable Desentara in round numbers to be 65 yojanas, which however, gives too strong a difference in time.

#### B

To convert this quantity into time, say: As circumference of the Circle of Longitude 4020,900 : to a natural day, or 60 guddias :: :: so 64,4 yo. :  $\frac{60g \times 64,4y}{4925.9} = 47$  vig. 4. paras.

Q E. In.

The time due to the difference of Meridians.

N. B .- If the degrees and minutes of Longitude be converted into time according to the European method, 4° 35' will give 45° 57°; the Natives at Madras take it 46° 47° (†).

Seva-desa-Paridhi, or circumference of the Paraflel Circle to the Lquator.

Assignable Desentara'in yojanas ard

in time.

<sup>(\*)</sup> In Table XXXIV will be found the Seva-desa-Paridhi, or circumference of the Circle of Longitude in yojanas, and the mid-day Equinoctial shadow in angulas, of the principal places in India,

<sup>(+)</sup> Vide Table XXXI.

# PROBLEM V.

The Latitude found by means of the Pa, labah.

Given the Palabah of some unknown place, which let it be 3° 30'. Wanted its Latitude, or Acsha Bagahs.

(N. B .- This proposition is but a repetition of Problem II, but is introduced here in reference to the commentary in the Appendix, whose Problems are all resolved for the Latitude and Longitude of Banda, near Masulipatam.)

The Vishama Carna, or Hypothenuse of the Equinoctial shadow will be determined, as in Problem II, by the formula.

$$\sqrt{\frac{2}{12+3y}\frac{2}{30}} = \frac{\text{Ang.}}{12} = \frac{\text{Vin.}}{30}$$

Then say, As Vishama Carna 12° 30': to Palabah 3° 30', so Radius, to Acshajya the Sine of Polar Altitude  $\frac{3a \ 30 \times 3438}{12 \ 30} = 962'$  corresponding to an Arc of 16° 15 the Latitude of Q. E. In. Banda.

# PROBLEM VI.

1' 11' North. Given the Sun's declination

The length of the Madhyama Chya, or mid-day shadow due to

Wanted the Acshu Bagahs (Latitude) and Natunsa (Zenith distance.)

Proceeding on the same principles as in Problem II, the Madhyama Carna, the Hypothenuse of Shadow due to 1° 11' declination North, will be

$$\sqrt{12^{2} + 314} = 12^{4} 26^{6}$$
B

Then say

The Zenith distance

The Latitude and Zenith distance by means of the Pala. bab, and Sun's de-

clioation.

The Natajya, or Sine of Zenith distance at noon, which corresponds to an Arc of 15° 4'.

In the present case as the Sun at noon, is South of the Zenith, and as his declination is North;

The Acsha Bagahs or Latitude.

or Natansa.

| their sum 15° 4 | + | 1. | 11' | = | 16* | 15', | gives t | the | Altitude | of | the | Pole, | as before | determined | i. |
|-----------------|---|----|-----|---|-----|------|---------|-----|----------|----|-----|-------|-----------|------------|----|
| (Prob. V.)      |   |    |     |   |     | -    |         |     |          |    |     |       |           |            |    |

#### SCHOLIUM.

When the Altitude of the Pole and the Sun's Declination are both given, the Madhyama Chaya or mid-day shadow for any day in the year may be found by reversing the foregoing rule.

# PROBLEM VII.

| Given the Sun's | Zenith dista | nce at noo | n | • | - | 15° 4′ S. |
|-----------------|--------------|------------|---|---|---|-----------|
| The Altitude of | the Pole     | -          | • | • | • | 16 15 N.  |
| The Palabah     |              |            | • | - | • | 3* 30*    |
| The Vishama Ca  | rna or Hypo  | thenuse    |   |   | • | 12 30     |

Wanted the difference between the Palabah and Madhyama Chaya on the day when such Zenith distance was observed at noon, and the Declination, or Cranti Bagahs.

Madhyama Chaya for any day in the year, and Declination or Cranti Bagahs.

#### Λ

The Zenith distance being South and the Latitude being North, take their difference.

| Zenith distance   | - | •   | • | • | • | 15° 4′ S. |
|-------------------|---|-----|---|---|---|-----------|
| Latitudė .        | - | • · | • | • | • | 16 15 N.  |
| Sun's Declination | • |     | • | • | • | 1 11 N.   |
|                   |   |     | B |   |   |           |

# Then say

To 
$$\frac{12 \text{ } 30 \times 71'}{3320} = 0^{\circ} 16^{\circ}$$
 which quantity subtracted from the Palabah  $\frac{3^{\circ}}{0} = \frac{3^{\circ}}{0} = \frac{3^{\circ}}{0}$ 

Madhyama Chaya or mid-day shadow for the day on which the Zenith distance was observed.

Q. E. In.

# PROBLEM VIII.

| Given the Altitude of the | e Pole | • | - | - | - | 16 | 15' N. |
|---------------------------|--------|---|---|---|---|----|--------|
| The Sun's Declination     | •      | - | • | • | • | 1  | 11' N. |
| The Palabah               | •      | - | - | • | - | 3* | 30*    |

Wanted the Sama-Mandala Chaya, or length of the shadow when the Sun is East or West.

Sama-Mandala Chaya.

| Say: As Sine Declination 1' 11' | - |   | _ | 71'  |
|---------------------------------|---|---|---|------|
| To Sine of Latitude 16' 15'     | _ | _ | _ | 0694 |

| To $\frac{963' \times 720'}{71'}$ = . 162° 36° the Mandala Carna or Hypothenuse of the Shadow. (*) | ,    |
|----------------------------------------------------------------------------------------------------|------|
| Mandala Carna or Hypothenuse of the Shadow. (*)                                                    | ,    |
|                                                                                                    | •    |
| ${f B}$                                                                                            |      |
| Lastly, the Sama-Mandala Carna being thus found to be 102 36; and the height of the                | anke |
| being always 12° or 720°, we have $\sqrt{102.30} - 720^\circ = 162°9°$ , the Sama-Mandala (sought. | -    |
| PROBLEM IX.  Given the Sun's Declination                                                           |      |
| m. Dili                                                                                            |      |
|                                                                                                    |      |
| eensional difference.                                                                              |      |
| Say first: As height of Sanku 12. C.                                                               |      |
| m a man                                                                                            |      |
|                                                                                                    |      |
| 9 (0 × 7)                                                                                          |      |
| $\frac{10}{12a}$ = 21'                                                                             |      |
| the Cshetijya.                                                                                     |      |
| <b>B</b>                                                                                           |      |
| Then: As Cosine Sun's Declination 1° 11'                                                           | ,    |
| To Cshetijya above found                                                                           |      |
| So Radius 3438'                                                                                    |      |
| To $\frac{2!' \times 3438'}{3456}$ - 21'                                                           |      |
| the Sine of the Ascensional difference sought, which does not differ sensibly from its Arc.        |      |
| Q. E.                                                                                              | In.  |
| PROBLEM X.                                                                                         |      |
| Given the Altitude of the Pole 16° 15'                                                             |      |
| The Sun's Declination 1° 11' N                                                                     |      |
| Wanted the Sun's Altitude at 10 dandas before and after noon.                                      |      |
| (*) Scholium.                                                                                      |      |
| The same result may be obtained by the following Canon:                                            |      |
| As Sine of Declination 1° 11'  To Cosine of Latitude 16° 15'  3299                                 |      |
| So Palabah 3a 30v                                                                                  |      |
| To 3299' X3a 36v. 162a 36v, the a                                                                  | une  |

as before.

# PREPARATION.

| V. 1          | 6° 15′ the S   | oine is  | 262         | •        | •                     | · •    | -    | Cos | sine 3299'             |
|---------------|----------------|----------|-------------|----------|-----------------------|--------|------|-----|------------------------|
| Of            | 1' 11' ,       | ,        | 71          |          | -                     | •      |      | ,   | , 3436                 |
| 10 da         | andas nnswe    | r to an  | Arc of      | 60° (*)  | whose                 | Cosine | is . | •   | 1719'                  |
|               | . •            |          |             |          |                       |        |      |     |                        |
| Say As Cosi   | ne Latitude    | ŀ        | •           |          |                       | •      | ~    |     | 3299                   |
| To its S      |                |          |             |          |                       |        |      |     | 962'                   |
| So Sine       | of Declinat    | ion      |             |          |                       | _      |      |     | 71'                    |
| Т•            | 969' ×71'      |          | •           | •        | -                     | •      | •    | 4   | 3' Sine of             |
| the Cshetijya | . <u>(</u> †)  | <u>.</u> | : :         |          |                       |        |      |     | •                      |
|               |                |          |             |          | B                     |        | •    |     | •                      |
| As Cosi       | ne Declinat    | ion      |             | •        | •                     |        | -    | :   | <b>3</b> 436'          |
| To Cshe       | etijy <b>a</b> | •        | •           | •        |                       | •      | •    | •   | 3′                     |
| So Radi       | u <b>s</b> .   |          | •           | •        | •                     | •      | •    | •   | <b>3</b> 13 <b>8</b> ′ |
| To            | 3×3438         | •        |             | •        | •                     | •      | .•   | •   | 3 Sine of              |
| the Charajya  | •              |          |             |          |                       |        |      |     |                        |
|               |                |          |             |          | C                     |        |      |     |                        |
| Add the C     | osine of the   | Hour     | Angle       | to the C |                       | •      | -    | Ş   | <b>17</b> 19'<br>3'    |
| You have t    | the Wutrajy    | a        | •           | •        | •                     | ;      | •    | •   | 1722                   |
|               |                |          |             |          | D                     |        |      |     | . •                    |
|               | : As Radio     |          | _           |          | •                     | ·      | •    |     | 3438'                  |
|               | To the Wu      |          | •           | •        | •                     | •      | •    | •   | 1792′                  |
|               | So Cosine      | Declina  | tion        | •        |                       | •      | •    | •   | 3436                   |
|               | To .           | •        | •           |          | <u>×3436</u><br>438 = | = 4    | •    | •   | 1721'                  |
| ilie Chadam.  |                |          |             |          |                       |        |      |     |                        |
|               |                |          |             |          | E.                    |        |      |     |                        |
|               | As Radius      |          | <b>,-</b> - | •        | •                     | •      | -    | •   | 3438                   |
|               | To the Cha     | dam      | •           |          | •                     | •      | •    | •   | 1721'                  |
|               | So Cosine of   | f Latit  | ude 16°     | 15       | •                     |        | •    | •   | <b>3</b> 299'          |

<sup>(\*)</sup> Table XXXI.

<sup>(†)</sup> The Hindus instead of saying: As the Cosine of the Latitude: to its Sine, always say: As the Sasku of Gnomon: To the Vishama Chaya, or Equinoctial Shadow, &c.

To the Yesta Sanku (\*)

$$\frac{1721 \times 3299}{3435} = 1652'$$

or Sine of the San's Altitude, whose Arc is 28° 45' at 10 dandas before and after noon.

Q. E. I.

| Problem XI.                    |   |   |   |   |           |     |     |      |
|--------------------------------|---|---|---|---|-----------|-----|-----|------|
| Given the Altitude of the Pole |   | • |   |   | <b>`-</b> | • . | 16° | 15'  |
| The Sun's Declination          | • |   | • | - | • a       | •   | 1   | 11 N |
| The Sun's Altitude             |   | • |   | - | •         | •   | 28  | 45   |

The time before or after neon,

Wanted the time before or after noon.

N. B.—The present proposition is only the converse of the preceding one.

# A

Say: as Cosine Latitude: Sine Sun's Altitude :: So Radius: to the Chadam

$$\frac{1652 \times 3458}{3.99} = 1721'$$

В

As Cosine Declination: to the Chadam :: So Radius: to the Wutrajya.

$$\frac{1721 \times 3438}{3436} = 1722'$$

C ·

r As Cosine Latitude: to Sine of the same:: So Sine of Sun's Declination: to the Cshetijya.

$$\frac{969 \times 71}{3.99} = 3$$

 $\mathbf{L}$ 

: As Cosine Declination: to the Cshetijya :: So Radius: to the Charajya.

$$\frac{3 \times 3438}{3430} = 3'$$

E

The Wutrajya (B) minus the Charajya (D) gives the Cosine of the Hour Angle from noon, i.e. 1722'-3'=1719'; the Arc answering to which is 60°; and this Arc answers to 10 dandas (†.)

As Yesta Drog Jya

To Yesta

So Yestu Chaya or length of Shadow

To height of the Sanku

whose Hypothenuse is sometimes called Yesta Carna.

(†) Table XXXI.

<sup>(\*)</sup> The Sine of the Sun's Altitude being called the Yesta, its Cosine is termed the Yesta Drog Jya; which suplains the following analogy.

# NOTE.

- 1º By help of the preceding Problems if the Altitude of the Pole be given, the Ravi Sayana, or Sun's Longitude reckoned from the Equinoctial point may be found from day to day, by means of the Madhyama Chaya or Meridian shadow.
- 2º The length of the shadow being known (Problem VI), the Sun's Zenith distance may be found.
- 3º The Meridian Zenith distance, and the Latitude of the place being known, the Sun's Declination may be found (Problem VII.)
- 4º The Obliquity of the Ecliptic being always 24°, and the Sun's Declination being given, the Hypothenuse or Arc of the Ecliptic between the Sun and Equinoctial points, called the Ravi Sayana, is easily found.

# SECTION II.

In order to determine the length of the Savan day, or the true time from Sun rise to Sun rise, in Sydereal time for every day in the year, we must establish: 1? What the Sun's Declination is when his Longitude (Ravi Sayana) is 1'; II'; and III'.—2? The Lagna, or its Right Ascension when his Longitude is in the said points of the Ecliptic.—3? The Agra or Amplitude of the Sun under the same circumstances.—4? The Chara or Ascensional difference under do.—5? The Utlagna, or Oblique Ascension of each Sign of Longitude counted from the Equinoctial points, for the particular Latitude which is to be computed for.

The length of the Bhumi Savan day,

10

To find the Sun's Declination when his Longitude is I'; II'; and III'.

Sun's Declination, 1st, 2d and 3d Signs.

| v | A | I | Λ |
|---|---|---|---|
|   |   |   |   |

| Obliquity of the Ecliptic (constant) | • | • |   | 24*   |
|--------------------------------------|---|---|---|-------|
| Its Sine, or Paramapa-Cramajya       | • | • | • | 1397′ |
| Cosine do                            | • | • | • | 3145′ |
| The Sine of 30° or I' the Yekajya    | د | • |   | 1719' |
| of 60 II the Duojaya                 | • | - | • | 2973  |
| of 90 III the Trijaya                | • |   |   | 3133' |

 $\frac{277^{\circ}/\times1397}{3435} = \frac{1211'}{20' 35'}$  the Sine of the Declination due to

II Sign or 60°,

|                                             | And for the III or 90° the greatest Declination being 24° its Sine is 1397'                                       |      |  |  |  |  |  |  |  |  |
|---------------------------------------------|-------------------------------------------------------------------------------------------------------------------|------|--|--|--|--|--|--|--|--|
|                                             | And Cosine                                                                                                        |      |  |  |  |  |  |  |  |  |
|                                             | Declination.                                                                                                      |      |  |  |  |  |  |  |  |  |
|                                             | Sines. 1) (11° 43′ - 698′                                                                                         |      |  |  |  |  |  |  |  |  |
|                                             | Signs 11 \ 20 33 1211                                                                                             |      |  |  |  |  |  |  |  |  |
|                                             | 111) (24 0 1397                                                                                                   |      |  |  |  |  |  |  |  |  |
|                                             | 20.                                                                                                               |      |  |  |  |  |  |  |  |  |
|                                             | To find the Lagna or Right Ascension under the foregoing circumstances.                                           |      |  |  |  |  |  |  |  |  |
|                                             | FORMULA.                                                                                                          |      |  |  |  |  |  |  |  |  |
| Sun's Right Accen-<br>sion, 1st, 2d, and 3d | As Cosine of Declination                                                                                          |      |  |  |  |  |  |  |  |  |
| Signs.                                      | To Cosine Obliquity of Ecliptic                                                                                   |      |  |  |  |  |  |  |  |  |
|                                             | So Sine Yekajaya, Duojaya, &c. or Longitude I, II or III.                                                         |      |  |  |  |  |  |  |  |  |
|                                             | To Sine of Right Ascension.                                                                                       |      |  |  |  |  |  |  |  |  |
|                                             | For I Sign.                                                                                                       |      |  |  |  |  |  |  |  |  |
|                                             | 3140/×1719' 1604' Also Sino of the Disks                                                                          |      |  |  |  |  |  |  |  |  |
|                                             | $\frac{3140'\times1719'}{3366'}=1604' \text{ the Sine of the Right}$                                              |      |  |  |  |  |  |  |  |  |
|                                             | Ascension, whose Arc is 27° 50'                                                                                   |      |  |  |  |  |  |  |  |  |
|                                             | For II Signs.                                                                                                     |      |  |  |  |  |  |  |  |  |
|                                             | $\frac{3140 \times 2978}{3366} = 2907'$                                                                           |      |  |  |  |  |  |  |  |  |
|                                             | the Sine of Right Ascension, whose Arc is . 57° 45'                                                               |      |  |  |  |  |  |  |  |  |
| ,                                           | For III Signa.                                                                                                    |      |  |  |  |  |  |  |  |  |
|                                             | We have of course \$438 (equal to Radius) - 90°                                                                   |      |  |  |  |  |  |  |  |  |
|                                             | Hence, Legna calas, or minutes of the Equator answering to each Sign respectively.                                |      |  |  |  |  |  |  |  |  |
|                                             | Signs II $\begin{cases} 1670' = 27^{\circ} 50' \\ 1795 = 57 45 - 27^{\circ} 50' \\ 1935 = 90 - 57 45 \end{cases}$ |      |  |  |  |  |  |  |  |  |
|                                             | 30                                                                                                                |      |  |  |  |  |  |  |  |  |
| Sun's Agra, or Am-                          | For the Sun's Agra, or Amplitude, under the same circumstances.                                                   |      |  |  |  |  |  |  |  |  |
| plitude for Do.                             | FORMULA.                                                                                                          |      |  |  |  |  |  |  |  |  |
|                                             | As Cosine of Pole's Altitude (13° 4' Mad                                                                          | ras) |  |  |  |  |  |  |  |  |
|                                             | To Sine of Sun's Declination A                                                                                    |      |  |  |  |  |  |  |  |  |
|                                             | So Radius                                                                                                         |      |  |  |  |  |  |  |  |  |
|                                             | To Agrajya or Sine of Amplitude.                                                                                  |      |  |  |  |  |  |  |  |  |
|                                             | ·                                                                                                                 |      |  |  |  |  |  |  |  |  |
|                                             | For I Sign.                                                                                                       |      |  |  |  |  |  |  |  |  |
|                                             | $\frac{698' \times 3438'}{3348} = 716'$ the Sine of the Sun's                                                     |      |  |  |  |  |  |  |  |  |
|                                             | Amplitude, whose Arc is 12° 1'                                                                                    |      |  |  |  |  |  |  |  |  |

For II Signs.

plitude, whose Arc is

• •

For III Signs.

$$\frac{1397 \times 3428}{3348} = 1434'$$
 the Sine of Am.

plitude, whose Arc is

Hence, the following Sun's Agras.

To find the Chara, or Ascensional difference, under the same circumstances.

Sun's Chara or Ascensional difference for Do.

FORMULA.

As Cosine Declination (Art. I)

To Sine of Pole's Altitude (13° 4')

So Sine of Agra (Art. 3)

To Sine of Chara, or Ascensional difference.

For I Sign.

$$\frac{716 \times 776.9'}{3306} = 165'$$
 the Sine of

Chara, whose Arc is

For II Signs.

$$\frac{1243 \times 776.2}{3366} = 286'$$
 the Sine of Chara,

whose Arc is

For III Signs.

$$\frac{1434 \times 776.2}{3366}$$
 = 331 the Sine of Chara,

whose Arc is

5° 31'

4' 46'

2 45

21' 12'

21' 40'

Hence, the Calas or minutes of the respective Ascensional differences are.

40

To find the Ullagna, or Oblique Ascension of each Sign of Longitude for any particular place, The Ullagna or Oblique Ascension.

Subtract the Chara Cumda from the Lagna, in the First and Fourth Quadrant of Longitude: add it in the Second and Third Quadrants.

| 1           | _ 1st and 1th Quadrants. |           |           | + 2d and 3d Quadrants. |            |            |  |  |
|-------------|--------------------------|-----------|-----------|------------------------|------------|------------|--|--|
|             | Is or XII.               | II or XI. | III or X. | IV or IX.              | V or VIII. | VI or VII. |  |  |
| Lagna       | 1670                     | 1795      | 1935      | 1935                   | 1795       | 1670       |  |  |
| Chara Cumda | 165                      | 121       | 45        | 45                     | 121        | 165        |  |  |
| Ullagna     | 1505                     | 167-1     | 1390      | 1930                   | 1916       | 1835       |  |  |

Such is the Ullagna of Madras, which, together with the Altitude of the Pole 13° 4′ and the Palabah 2 angulas, 47 vinculas, exhibit constant quantities for calculating the duration of the artificial and natural day throughout the year. Every Indian Astronomer, or Almanac maker, generally calculates a Table of this sort for the place where he resides.

51

For the Sun's diurnal motion in Oblique Ascension.

#### A

The Sun's true diurnal motion on the day commencing the Luni-solar year Cali yugam 4924 was 59' 26", and his true place (Sputa Graha) in the Hindu Ecliptic - 11' 11' 36' 19" (\*)

| The Ayanansa for Do.                  | - | - | • | 19 50 25      |
|---------------------------------------|---|---|---|---------------|
| Ravi Sayana or true Longitude         | • | • | - | 0 1 26 44 (+) |
| So that the Sun is in the first Sign. |   |   |   |               |

|                                             | $\mathbf{B}$ |           |          |          |                 |
|---------------------------------------------|--------------|-----------|----------|----------|-----------------|
| Say then: As 30° (I Sign), or in calas      | -            |           | ~<br>•   | <b>-</b> | Calas.<br>1300  |
| To the Ullagna of the 1st Sign              |              | •         |          | •        | 1505            |
| So Sun's true diurnal motion in t           | he Eclip     | etic on t | he giver | day      | 59′ 26 <b>*</b> |
| To \(\frac{1505' \times 39'  26''}{1500} \) | •            |           | •        | •        | 49′ 41″         |

The Arc of the Equator which rises above the Horizon in the same time, being the Sun's diurnal motion in Oblique Ascension on the given day.

C

For the length of the Savan day.

As the natural day of 60 dandas (according to the Murta denomination) contains 21600 pranacales or respirations, which is the same number as there are of cales (minutes) in 360°, the

Diurned motion in Oblique Ascensien and length of natural day.

<sup>(\*)</sup> Vide computation of Elements.

<sup>(+)</sup> La the present case the Booja is not required.

circumference of the Equator; the above motion 49cal. 41vic. in Oblique Ascension may be considered as pranacalas, which therefore dividing by 6, gives 8vic 1,6pra. (\*)

The length of the Savan day from Sun rise to Sun rise is, therefore,

| Dandas. | Vicalas.<br>8 | Pranacalas.<br>1,6 Sydereal time |
|---------|---------------|----------------------------------|
|         | 60            |                                  |

To find the length of the artificial day, or time of the Sun being above the Horizon.

Length of artificial day.

0° 1° 26′ 44″

87'

#### A

We have found in the preceding article that the length of the Bhumi Savan day on which the Luni-solar year Cali yugam begun, was 60<sup>d</sup> 8<sup>v</sup> 1,6<sup>p</sup>, Sydereal time, one fourth part of which is 15<sup>d</sup> 2<sup>v</sup> 0,4<sup>p</sup>, or 15<sup>s</sup> 2<sup>v</sup> 4<sup>p</sup>.

В

|                      | For the | Sun's | Decunat | ion on t | ne same | ua y . |
|----------------------|---------|-------|---------|----------|---------|--------|
| Given the Sun's Ravi | Sayana  |       | •       | -        | •       | -      |
| Whose Sine is        | -       | -     | -       | -        | -       | -      |

Obliquity of Ecliptic 24° and Paramapa-Cramajya - 1397′
Say: As Radius - - - 3138′

To Sine Ravi Sayana - - - 87'
So Paramapa-Cramajya - - 1397'

(Sine of Obliquity)

To Crantijya  $\frac{87' \times 1397'}{3438} =$  35'

the Sine of the Declination sought, equal to its Arc.

·

For the Sun's Chara, or Ascensional difference.

| DataThe Pole's Altitude         |    | 13* 4' | Sine.<br>777' | Cosi<br>33 |             |
|---------------------------------|----|--------|---------------|------------|-------------|
| Sun's Declination N.            | -  | 35*    | 35 <b>'</b>   | 34         | 3 <b>7′</b> |
| Say: As Cosine Polar Altitude   | -  | -      | -             | •          | 3348'       |
| To Sine of the same             | -  | -      | -             | -          | 777'        |
| So Sine of Sun's Declination    | ı  |        | -             | •          | 35′         |
| To - <sup>777</sup> ·×35′/3318′ | == | - •    | •             | -          | 8′          |

the Cshetijya; which gives only a first approximation.

<sup>(\*)</sup> To convert the 49 calas, 41 vicalas (in degrees) into time, we have for the calas  $\frac{42}{6}$  = Sv lp, and 60: 41:7 I0: 6. Hence the time would be 8v 1,6p.

| 1  | 106 | ) |
|----|-----|---|
| ١. | 100 |   |

20

| As ( | Cosine ! | Sun's | Declination | n | • | _ | • |   | - |   |   | 3437  |
|------|----------|-------|-------------|---|---|---|---|---|---|---|---|-------|
| То   | Cshetijy | ya    | •           |   | ~ |   | • |   | - |   | - | 8′    |
| So I | Radius   |       | -           |   |   | - |   | • | - |   | - | 3438' |
| To   | _        |       | 8' ×3438    | = | - | _ |   |   |   | • | - | 7'    |

the Charajya, or Sine of the Ascensional difference sought.

Hence the Sun's Chara on the first day of the year Cali yug 4923 was 7', which corresponds to 1 vig. 10 paras of time nearly. (\*)

D. For the Dinarda, and Ratri Arda.

Because the Sun's Declination is North-To the 4th part of the Savan

|                 | day (A)                       |     | _       | -    |   | . 15 | 2" | 4"  |
|-----------------|-------------------------------|-----|---------|------|---|------|----|-----|
|                 | Add the time of the Chara (C) | -   | -       | -    | - | +    | 1  | 10  |
| Half the day.   | Dinarda, or half the day      | -   | -       | -    | - | 15   | 3  | 1-4 |
|                 |                               | And | -       | •    | - | 15   | 2  | 4   |
|                 |                               |     |         |      |   |      | 1  | 10  |
| Half the night, | Ratri Arda, or half the night |     | -       | •    | - | 15   | o  | 5-1 |
|                 |                               |     | Conclus | ion. |   |      |    |     |

The day.

The artificial day, or Bhumi Savan dina, which opened the Luni-solar year Cali yugam 4923, was, therefore,

> 2×15; 3' 14" == 30: 6' 28'

The night,

Time of Sun rising.

Time of Sun setting.

And the artificial night

2×15° 0° 54° == 30

## COROLLARY.

| Hence if from 60+15° =                                   | - | - | 75° |    |    |
|----------------------------------------------------------|---|---|-----|----|----|
| We subtract the Dinarda                                  |   | • | 15  | 3  | 14 |
| Time of Sun rising at Madras on the given day,           |   |   | 59  | 56 | 46 |
| And if we add thereto the duration of the artificial day |   | - | 30  | 6  | 28 |
| The time of Sun setting on the same day, (90°-60°) =     |   | - | 30  | 3  | 14 |

It will be readily perceived that these resolutions differ materially from those procured by European Astronomy, which is to be particularly ascribed to the defective Longitude assigned to the Sun in the Indian Calculus.

#### ARTICLE 9.

Having thus expounded the doctrine of Hindu Gnomonics, we are now to apply it to the reduction of the end of the Amavasya Tidhi calculated for Lanca in the preceding article, to any other Meridian or Latitude; and I shall select for that purpose, those of Madras, its Acsha Bagahs being 13° 4′, Desentara in time 47° 4° East of Lanca: and Palabah 2° 46,8°.

For this we are to correct the Sun and Moon's Sputa Graha, or true places in the Indian Zodiac, as found at page 88, for midnight at Lanca, to what they were when it was midnight at Madras.

Reduction of the end of the Amavasya Tidhi at Lanca to any Meridian or Latitude.

#### DATA.

| O's Sputa Graha at | true mic | lnight at | Lanca | on the 1 | 2th Poor | ngoni - | 11' | 11° | 36′ | 19* |
|--------------------|----------|-----------|-------|----------|----------|---------|-----|-----|-----|-----|
| ⊙'s "Gati or ti    | ue motic | n         | -     | -        | -        | -       |     |     | 59  | 26  |
| D's Sputa Graha on | Do.      | -         | •     | -        | -        | -       | 11  | 17  | 51  | 22  |
| D's Do. Gati       | •        | •         | -     | -        | •        | -       |     | 14  | 1   | 54  |
| Desentara in time  | •        | -         | -     | •        | •        | -       |     |     | 47* | 4°  |
| Acsha Bagahs       | •        | -         | -     | •        | -        | •       |     |     | 13° | 4'  |
| Relative motion    | ~49      | -         | -     | •        | •        | -       |     | 13° | 2′  | 28* |
|                    |          |           | A     | Ľ        |          |         |     |     |     |     |

12th of Poongoni at true midnight at Lanca. Time complete.

For the Sun's place on the 12th Poongoni 4923, reduced to the Meridian of Madras.

Say: 60 guddias: 59' 26' :: 47' 4":  $\frac{59 \cdot 26 \times 47 \cdot 4}{60 \text{g}} = 46''$ , and as the Longitude of Madras lies East of Lanca, this quantity is subtractive.

Sun's true place at Lanca - - 11' 11° 36' 19"

Subtract motion during 47' 4P - 46

O's Sputa Graha on the same day at midnight at Madras - 11 11 35 33

B

For the Moon's place, reduced to the same Meridian.

The Moon's true motion on the given day was 14° 1' 54", therefore say

:  $60^{\circ}$ :  $14^{\circ}$  1' 54 ::  $47^{\circ}$   $4^{\circ}$ :  $\frac{14 + 1}{60^{\circ}}$   $\frac{154 \times 47 + 4}{60^{\circ}}$  = 11' 0", being the Moon's progress in the given time, which, as the Moon was proceeding from the Sun, is *subtractive*.

 D's Sputa Graha at Lanca
 11' 17° 51' 22"

 Subtract
 11 0

 Moon's Sputa Graha at midnight at Madras
 11 17 40 22

( 108 )

C

| $oldsymbol{\Gamma}$ or t | the Sun | and | Moon's | true | distance. |
|--------------------------|---------|-----|--------|------|-----------|
|--------------------------|---------|-----|--------|------|-----------|

| ⊙'s Sputa Graha        | -        | -              | - | • | • | 11'           | 11° | 35 <b>′</b> | 33* | (A) |
|------------------------|----------|----------------|---|---|---|---------------|-----|-------------|-----|-----|
| D's Do. Do.            | -        | -              | - | = | - | 1I            | 17  | 40          | 22  | (B) |
| Soob-vi-Arca Indoo Gra | aha at M | ladra <b>s</b> | • | • | • | <del></del> - | 6   | 4           | 49  | •   |
|                        |          |                | Ð |   |   |               |     |             |     |     |

For the time due thereto, say

: 13° 2′ 28″ (Rel. mot.) : 60° :: 6° 4′ 49″ (C) 
$$\frac{60g \times 6^{\bullet} \cdot 4' \cdot 49''}{13° \cdot 2' \cdot 28''} = 27^{\circ} \cdot 58' \cdot 27'$$

time before midnight when the conjunction occurred.

| Therefore subtracting fr | om mea          | n midi | night   | -    |      | -     | 45<br>27 | 58          | 07          |
|--------------------------|-----------------|--------|---------|------|------|-------|----------|-------------|-------------|
| Time of conjunction aft  | e <b>r</b> mea. | n Sun- | rise at | Madi | as o | n the |          | <del></del> | ~ <i>'</i>  |
| 12th Poongoni,           | -               | -      | -       | -    | -    | -     | 17       | 1           | 33          |
| •                        | -               |        | •       |      |      | -     |          |             | <del></del> |

E

For time after true Sun rise.

| We have found at Section Hof Gnomo     | nics (pag | e 106), | that      | the Sun rose |      |                 |              |
|----------------------------------------|-----------|---------|-----------|--------------|------|-----------------|--------------|
| on the 12th of Poongoni, at Madras, at | •         |         | -         | -            |      | <b>v.</b><br>56 |              |
| Equation of time -                     | -         | -       | <b>(=</b> | -            | 0    | 3               | 14 additive. |
| Time of conjunction after mean         | 1 Sun-ris | e by p  | resent    | operations   | - 17 | 1               | 33           |
| End of Amavasya Tidhi                  | -         | -       | -         | -            | 17   | 4               | 47           |

True time of conjunction after Sun rise under the Meridian and Latitude of Madras. or instant of conjunction after true Sun rising, being the end of the 30th, or Amavasya Tidhi of the Lunar month *Phalguna* of the 4923d year of the Cali yug, and the beginning of the *Prathama* or 1st Tidhi of Chaitra of the 4924th year current, under the Meridian and Latitude of Madras.

And as the said Prathama Tidhi began after Sun rise on the 12th Poongoni, it is to be coupled with the 13th of the said Solar month, as may be seen in the Skeleton of the Panchangum, page 67.

I shall close this article with a remark of Audi Sashaya Sastra.

Some of the Moon's Equations not considered in this process.

In the computation of Eclipses wherein the Elements must be rigidly computed, the Moon's place is subject to other Equations, which need not be considered in the construction of the common articles of the Panchangum, where the resolution of the end of the Tidhis, and disposition, and duration of the months and years, are principally considered. In the Solar or Vakiam process, of which a general account will be given in the second part of this Memoir, all the Equations which have been theoretically accounted for in the preceding articles, are computed by means of Tables where, in some cases, two or three are blended together, so as to be quite undistinguishable.

Thus for instance, what the Tamuls call the Arca Bahoota phala, Desentara, and Beeja phala Suriscaras, which are to account for the difference between mean and true time, of Longitude and Latitude, as these circumstances affect the Moon's place at a given instant and spot on the surface of the Earth, they compute together under the general designation of Desentara Sumscara, or Equation of Longitude, so that the vast majority of those who use these Tables and processes, are absolutely unable to give the least account of their construction.

How the Tamul Kalendar makers compute some of their Equations.

Whatever process is followed, however, these reductions are very long and tiresome. The preceding investigation of Hindu Gnomonics has enabled me to dispose rapidly of the latter part of the last Problem, but the reader will have perceived that, in order to reduce the end of a Tidhi, and consequently that of any month and year, from its time at Lanca to any other place arbitrarily proposed, requires more time than the utility of such a proposition deserves when it does not refer to some of the higher Astronomical Problems. In order not to fatigue uselessly his attention, I shall therefore dispense in future from carrying my computations further than Lanca, excepting in the last Example of all, where I propose giving an entire solution of the Cshayu or expunged month, which will occur in the 5065th year current of the Cali yug; answering to the 1886th from the birth of Salivahana, and to the Christian year 1963.

ARTICLE 10.

How to compute Seriatim all the Tidhis in the year, the end of the last Amavaeya Tidhi of the preceding year being given.

We have been under the necessity of interrupting our progress in the construction of the Kalendar, for the sake of elucidating the various theories on which it is to be modified according to time and place: we shall now resume the original research, to show how the end of the successive Tidhis of the new year may be determined, from the resolution of the end of that which closed the preceding one.

The beginning of the 1st Tidhi in the year being computed, how to find all the rest,

We have seen that the Amavasya Tidhi which ended the year Cali yugam 4923, and commenced the 4924th, at Lanca, terminated after Sun rise on Poongoni 12th, (page 90) [16\* 14\* 28\* Add 1 13th

to which date we are to adapt the Elements already obtained.

For the Sun's apparent place on the 13th Poongoni. O's Madhyama Graha on the 12th, (page 87) 11 9° 26' 374 O's mean motion in one day 59 8 Madhyama Graha on the 13th 11 10 25 45 Place of Sun's Mandocha (Apogee) its motion insensible 2 17 17 18 Ravi Manda Kendra 3 6 33 6 Bhujah 2 23 8 27 Argument of Anomalistic Equation 8' 27" 507"

Proceeding as we have done before, we shall find the Ravi Manda P'hala 2º

| And the Arca Bhagábala          | 2° 9′ 38″ | (*) |   | • | • | +   |    |          | 23 |
|---------------------------------|-----------|-----|---|---|---|-----|----|----------|----|
| ⊙'s Madhyama Graha above four   | ıd "      |     | - |   | • | 11' |    | 10<br>25 | _  |
| Ravi Sputa Graha, 13th Poongoni | , -       |     | - | - |   | 11  | 12 | 35       | 45 |

## For the Sun's true motion.

The Sun's apparent place.

Instead of deriving it as usual from the Tables, when computing seriatim, the Hindas cake the difference of the Sun's Sputa Graha on the two successive days, because the increment or decrement of its Sputa Gati, (apparent motion) is comprehended in the Arca Bhagábala (page 88) as above applied (†).

The Sun's true motion.

We have consequently

For the Moon's true place on the 13th Poongoni.

First correct the Moon's mean place.

| D's Madhyama Graha, 12th Poong | oni | - | - | 11" | 21° | 15' | 34" |
|--------------------------------|-----|---|---|-----|-----|-----|-----|
| D's mean motion in one day     | =   | • | • |     | 13  | 10  | 35  |
| Madhyama Graha, 13th Poongoni  |     | • | • | 12  | 4   | 25  | 9   |

(‡) Area Bhagábala depending on the Sun's Anomalistic

| Equation    |           | -        | -      | • |   | 2. 0. 334 | =  | 4      | 48  |
|-------------|-----------|----------|--------|---|---|-----------|----|--------|-----|
| D's Correct | æd Graha, | i3th Pec | ongoni |   | • | ž į       | 0. | 4` 30' | 57" |

<sup>(\*)</sup> The regular process for resolving the Area Bhagábala would be

: 360°: 59′8″:: 5° 9′ 35″ (Anom. Equat.) 
$$\frac{59′8″ \times 2° 9′38}{360°} = 25$$

the same result as that used in the text. The two processes solden wary by  $1^{\prime\prime}$ . So that the short one may be used with All arfety for general purposes.

(1) The regular process would be

<sup>(†)</sup> The explanation, as well as many others innerted in this work, were literally given to me by the Native States whom I consulted on these operations.

 $\mathbf{B}$ 

For the place of the Moon's Apogee on the 13th Poongoni.

| Place of Mandocha on the 12th Poongoni  | - | -           | 7'     | 4°           | 35'        | 53#        |
|-----------------------------------------|---|-------------|--------|--------------|------------|------------|
| Motion of Do. in one day                | • | +           |        |              | б          | 41         |
| Place of Mandocha on the 13th Poongoni  | • | •           | 7      | 4            | 42         | 34         |
| D's Corrected Graha (preceding article) | - | <del></del> | 0      | 4            | <b>3</b> 0 | 5 <b>7</b> |
| Chandra Manda Kendra                    | • |             | 7<br>6 | 0            | 11         | 37         |
| Argument of Anomalistic Equ. Bhujah     | • | -           | 1      | 0.           | [11        | 37         |
|                                         |   |             |        | <b>3</b> 0 [ | 11         | 37         |
|                                         |   |             |        |              |            | 97"        |

C
Chandra P'hala Table for 30° - 2° 32′ 2
31 - 2 36 37

4 35 = 275°

For fractional part

The Moon's true place,

the Tidhi Sputa, or Argument of the true Tidhi on the 13th.

ond D's distance at midnight.

How to find the end of the Prathama Tidhi, which began with the Amavaya ending, by means of that distance.

A

As the duration of a Tidhi is determined by the time that the Moon takes to run through 12° relatively to the Sun, we may have the Moon's true motion in one day, as we had that of the Sun, tiz.

| Meon's true mot.on.                                                                  | D's Sputa Graha on the 12th I                                                                                                                                                                                              |                                                                                               | **                         | •                            |                |                          |          |           |         |
|--------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------|------------------------------|----------------|--------------------------|----------|-----------|---------|
|                                                                                      | D's Graha on the 13th do. (p                                                                                                                                                                                               | age 111)                                                                                      | •                          | -                            | + (            | ) 1                      | 58       | 1         |         |
|                                                                                      | D's Sputa Gati on the 13th                                                                                                                                                                                                 | •                                                                                             | •                          |                              | - (            | ) 14                     | 6        | 39        | and     |
|                                                                                      |                                                                                                                                                                                                                            | Relative mo                                                                                   | otion.                     |                              |                |                          |          |           |         |
| Relative motion.                                                                     | ⊙'s Sputa Gati •                                                                                                                                                                                                           |                                                                                               | -                          |                              |                |                          | 59       | 26        |         |
|                                                                                      | Vi-Arca-Indoo-Gati                                                                                                                                                                                                         | -                                                                                             | •                          |                              |                | 13                       | 7        | 13        |         |
|                                                                                      |                                                                                                                                                                                                                            | В                                                                                             |                            |                              |                | <del></del>              |          |           |         |
|                                                                                      | The distance on the 13th at t                                                                                                                                                                                              | rue midnight                                                                                  | at Lanca                   | , was fo                     | ound           |                          |          |           |         |
|                                                                                      | (preceding article)                                                                                                                                                                                                        | •                                                                                             |                            | -                            | O'             | 10,                      | 22'      | 16"       |         |
|                                                                                      | Subtract motion for a Tidhi                                                                                                                                                                                                | -                                                                                             | •                          | • -                          | _ 0            | 12                       |          |           |         |
| Arc of excess at mid-<br>night.                                                      | Excess of motion over a whol                                                                                                                                                                                               | e Tidhi at mi                                                                                 | dnight                     | •                            |                | 7                        | 22       | 16        |         |
|                                                                                      |                                                                                                                                                                                                                            |                                                                                               |                            |                              |                |                          |          |           |         |
|                                                                                      | For time due to this excess, say                                                                                                                                                                                           | E                                                                                             |                            |                              |                |                          |          |           |         |
|                                                                                      | For time due to this excess, say : as 13° 7' 13" (Rel. mot.):  To be retrenched from midnight at 1                                                                                                                         | 60° :: 7° 22′                                                                                 | 16": -                     | <u>13• 1√</u><br>3×2• 55     | <u>' 16"</u> = | <b>-</b> 33              | 42′      | 31"       |         |
|                                                                                      | : as 13° 7′ 13" (Rel. mot.):                                                                                                                                                                                               | 60° :: 7° 22′                                                                                 | 16":                       | 13° 1⁄ ]<br>3×7° 88          | <u>' 16"</u> = | : 33°<br>45g<br>33.      | 42'      | 31"<br>31 |         |
|                                                                                      | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at 1                                                                                                                                                          | 60° :: 7° 22′                                                                                 | 16": 6                     | 9×7° 99                      | ' 16"          | <b>4</b> 5g              |          | 31        | after : |
| na or Padhyami                                                                       | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at 1  Say therefore                                                                                                                                           | 605 :: 7° 22'                                                                                 | #<br>*                     | •                            | <u> </u>       | 45g<br>33.               | 42       | 31        | after   |
| na or Padhyami                                                                       | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at 1 Say therefore  End of the Prathama Tidhi                                                                                                                 | 605 :: 7° 22'                                                                                 | #<br>*                     | •                            | <u> </u>       | 45g<br>33.               | 42       | 31        | after : |
| End of the <i>Pratha-</i><br>ma or Padhyami<br>Fidhi,<br>Registering the Tid-<br>bi, | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at 1 Say therefore  End of the Prathama Tidhi rise, and beginning of the Vidya Tidhi As the Vidya Tidhi began on the 1                                        | 60 <sup>3</sup> :: 7 <sup>6</sup> 22 <sup>2</sup> Lanca.  , or 2d Chait  Note.  13th after Su | ram, A.                    | C. 492                       |                | 45g<br>33.<br>11<br>ent. | 42<br>17 | 31        |         |
| ne or Padhyami<br>fidhi.<br>Registering the Tid-                                     | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at least therefore  End of the Prathama Tidhi rise, and beginning of the Vidya Tidhi                                                                          | Lanca.  or 2d Chait  Note.  3th after Su  the Panchar                                         | ram, A.  n rise, ingum. (V | C. 492                       |                | 45g<br>33.<br>11<br>ent. | 42<br>17 | 31        |         |
| re or Padhyami fidhi.  Registering the Tid- ii.                                      | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at least therefore  End of the Prathama Tidhi rise, and beginning of the Vidya Tidhi As the Vidya Tidhi began on the 1 Poongoni, which is accordingly done in | Lanca.  or 2d Chait  Note.  3th after Su the Panchar                                          | ram, A.  n rise, ingum. (V | C. 492<br>t is to<br>ide pag | 4 carr         | 45g 33.                  | 42<br>17 | 31<br>29  | e 14th  |
| ne or Padhyami<br>Fidhs.<br>Registering the Tid-                                     | : as 13° 7′ 13" (Rel. mot.):  To be retrenched from midnight at 1 Say therefore  End of the Prathama Tidhi rise, and beginning of the Vidya Tidhi As the Vidya Tidhi began on the 1                                        | Lanca.  or 2d Chait  Note.  3th after Su the Panchar                                          | ram, A.  n rise, ingum. (V | C. 492<br>t is to<br>ide pag | 4 carr         | 45g 33.                  | 42<br>17 | 31<br>29  | e 14th  |

we shall have the Arc which the Moon has to describe from the Sun before marking the end of the Vidya Tidhi, and beginning of the Tadya, or third Tidhi: but in order to get the correct time due to the same, the Sun and Moon's relative motion for the 14th of Poongoni must be computed; then the last proportion will hold good as before; et Ceteris paribus.

Beginning of the Tadya Tidhi.

<sup>(\*)</sup> Vide also description of the Siddhanta Chandra Panchangum, paragraph 10, page 72.

#### ARTICLE 11.

Resolution of a Cshaya Tidhi, or expunzed Lunar day.

It has been observed (para. 7, page 72), that whenever a Lunar Tidhi commences and ends on the same Solar day, the precept requires that it be expunged out of the Kalendar; so that when such a case occurs, there is a chasm of an unit between two successive Tidhis. As this case recurs, on a medium, once in 64 days, the Epoch of any one Cshaya Tidhi being known, any other (past or future) may be anticipated within a day.

The Tidhis computed independently.

In the present Example I shall assume, that a mean Cshaya Tidhi was due about the 5th or 9th Vaisacha of the current year Cm. 4921 and proceed to the resolution of the same, following still the precepts of the Surriah Siddhanta.

In what follows, I shall only give in detail what may be new to the reader; but the quantities, the resolutions of which have already been explained, will be given in the abstract. It would, however, be quite impossible to give an intelligible account of what remains unexplored of these processes, if repetition were entirely excluded; and on that account I claim the reader's indulagence for unavoidable prolixity.

Ī.

For the Sun's mean place on the 8th Vyassei complete.

We have found at page 87, that the Sun's Madhyama Graha on the 12th of Poongoni, Sydereal time, was 11° 9° 26' 37'.

#### A

To find the number of Savan days between the 12th of the Solar month Poongoni, 4923, and the 8th Vyassei 4924.

| By the Solar Kalendar the Sydereal month        | P            | oongoni cou  | nts   |      |   | Days.      | Number of days to<br>be computed for the |
|-------------------------------------------------|--------------|--------------|-------|------|---|------------|------------------------------------------|
|                                                 |              | Subtract     | -     | •    | • | 12         | 8th Vyassei.                             |
|                                                 |              |              |       |      |   | _          |                                          |
|                                                 |              |              |       |      |   | 19         |                                          |
| Duration of all Chaitram (Kal.)                 | 7            | -            |       | *    |   | 31         |                                          |
| Proposed date in Vyassei                        |              | ~            |       | •    | - | 7 complete |                                          |
| Number of Savan days for which the Sun and Moon | ı <b>'</b> S | motion is to | be fo | ound | ~ | 57 days.   |                                          |

| $\mathbf{R}$ | 611    | STINE   |
|--------------|--------|---------|
| 14           | 1 11 T | - I' N. |

|                                | B. THE SUN.                                                                                                                                                                      |
|--------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                | By Table XX, we have for 50 days                                                                                                                                                 |
|                                | Add Sun's Madhyama Graha, 12th Poongoni 1 26 10 45                                                                                                                               |
| Sur's mean place,              | 3's Madh. Graha, 8th Vyassei complete, 9th current (*) 1 5 37 22                                                                                                                 |
|                                | C. THE MOON.                                                                                                                                                                     |
|                                | D's Madh. Graha, 12th Poongoni (page 89)       11° 21° 15′ 34″ - 7° 4° 35′ 53         By Table XXI, for 50 days       - 9 28 49 3 - 0 5 31 9         7 ,, - 3 2 14 4 - 0 0 46 47 |
| Meen place of Moon and Apagee, | Moon's Madh. Graha and Mandocha, 8th<br>Vyassei complete; midnight at Lanca, 0 22 18 41 7 10 56 49                                                                               |
|                                | Section I.                                                                                                                                                                       |
|                                | A.                                                                                                                                                                               |
|                                | Elements for the 8th Vyassei complete, A. C. 4924 current.                                                                                                                       |
|                                | ⊙'s Madhyama Graha 1° 5° 37′ 22″                                                                                                                                                 |
| ***                            | O's Mandocha (motion insensible) - 2 17 17 18                                                                                                                                    |
| Elements.                      | D's Madhyama Graha 0 22 18 41                                                                                                                                                    |
|                                | D's Mandocha 7 10 56 49                                                                                                                                                          |
|                                | Proceeding as before, these quantities will give us:                                                                                                                             |
|                                | THE SUN.                                                                                                                                                                         |
|                                | O's Anomalistic Argument or Manda Kendra - 1° 11° 39′ 56"                                                                                                                        |
|                                | ,, Anomalistic Equation or Manda P'hala - + 1 27 30                                                                                                                              |
|                                | ,, Area Balioota P'hala ,, ,, ,,                                                                                                                                                 |
|                                | O's true place or Spata Graha - 1 7 5 6                                                                                                                                          |
|                                | ,, true motion 57 28                                                                                                                                                             |
|                                | THE MOON.                                                                                                                                                                        |
|                                | )'s Anomaly 5' 11' 22' 7"                                                                                                                                                        |
|                                | ,, Ehoja, Argument of Equation - 6 18 38 8 (†)                                                                                                                                   |
|                                | ,, Chandra Phala, Anom. Equa 1 37 17                                                                                                                                             |
|                                | ,, Arca Ban Sumscara P'hala - + 5 14                                                                                                                                             |

<sup>(\*)</sup> This would be marked the 9th in the Panchangum, which always gives the current day. But as the fraction of the Ahargana for the 1st Vyossei is (Sunday) SSz. 10v. 10p. (as appears in the Kalendar given at the head of this Memoir), the Civil account for all that month dates one day less, and is therefore put down 8th current.

and

o' 22° 18′ 41° \_ 1° 37′ 17″+3′ 14″=0' 20° 44′ 38″

D's Sputa Graha at midnight of the 8th Vyassei complete, at Lanca.

,, true motion found as before 14' 16' 19".

B

Hence for the resolution of the end of the Tidhi, we have the following corrected Elements.

| At midnight \$ @'s Sputa Graha at Lauca & D's do. do. |      | 1' 7° 5′ 6″<br>0 20 44 38 | True distance 8th<br>Vyassei complete. |
|-------------------------------------------------------|------|---------------------------|----------------------------------------|
| ⊙ and D's true distance -                             | •    | 0 16 20 28                |                                        |
| At S O's Sputa Gati Lanca D's Do. Do.                 |      | 0° 57′ 28″<br>14 16 19    | End of 8th.                            |
| Soob-vi-Arca Indoo Gati or Relative Motion            | es w | 13 18 51                  |                                        |
| C                                                     |      | <del></del>               |                                        |

Resolution of the end of the Tidhi.

As the Moon moves through 12 degrees of her Synodical Revolution in one Tidhi, the Hindu Astronomers have found means of abridging the process by computing, first "How many "complete Tidhis have elapsed in the Bhuja, or complement to 360° of the San and Moon's 46 Revolutions on the proposed day; and, secondly, by finding the time due to the remainder."

Shortening the pro-

10 Say : As 12° : To 1 Tidhi :: 343° :

:  $\frac{1\times343}{15^{\circ}}$  = 28 Tidhis complete, with a remainder of 7°+39′ 32″ of the Bhuja unaccounted

Number of Tidhis expired on the given

for, but which shall be considered presently.

The quotient, which was found to be 28, shews that the Tidhi sought, is the 28th of the Lunar month Vaisacha complete, and as we have worked for the 8th Vyassei Solar time, also complete, that Tidhi is to be coupled with the said Solar day.

And on account of the division of the Lunar month into two Putchums, it is customary to register the same 28-15=13th Christna Patchum; which is accordingly done in the Panchan. gum, page 67.

To proceed.

20 As there were 28 complete Tidhis expired at the time for which the computation was made. the remainder, after division by 12° (viz. 7° 39' 32") indicates a part of the 29th Tidhi (then current) which had expired, and in order to determine its end, or the beginning of the 30th Tidhi (which is always that of the conjunction)

Remainder to the conjunction.

For the end of the 29th Tuthi,

Registering the Tid-

For the 20th or A-mayasya Tidh', being an expunged one.

| (                                                                                         | 116 )                     |                    |               |
|-------------------------------------------------------------------------------------------|---------------------------|--------------------|---------------|
| Say • • •                                                                                 |                           | From 12"           |               |
|                                                                                           |                           | Take 7 39          | 32            |
| Arc due to what remained of the                                                           | 29th Tidhi, in degrees,   | &c. } 4 20         | 28            |
| at miduight at Lauca                                                                      | D                         | <b>)</b>           |               |
|                                                                                           | D                         | f.d. cod ff: v     |               |
| For the time due to this Arc, considering                                                 |                           |                    |               |
| the 9th Vyassei, we require the true relati                                               | ive motion for that day   |                    | •             |
| will be found to be                                                                       | -                         | . 13 2             | 2' 26"        |
| Say therefore,                                                                            |                           |                    |               |
| : Relative motion 13° 22' 26": 60"::                                                      |                           |                    |               |
| Arc of complement 4° 20′ 28″:  : Time due to Arc from midnight at Lar                     | nca 60× 4° 20 28          |                    | 19: 28: 32:   |
|                                                                                           |                           | Add midnight       | 45            |
|                                                                                           |                           |                    | 61 28 32      |
|                                                                                           |                           | Subtract           | 60            |
| Time of 29th Tidhi ending after Sun rise o                                                | n the 9th Vyassei, or beg | ginning of the 30t | h 4° 28' 32°  |
| said month. The remainder of the Example ment.                                            | Section II.               | the case admits of | that arrange. |
|                                                                                           | A                         |                    |               |
|                                                                                           | he 30th or Amavasya I     | lidhi.             |               |
| Proceeding as before, for the 9th Vyasse                                                  | _                         | an ma 4.4          |               |
| At midnight & O's Sputa Graha, at Lanca & D's Do. Do.                                     | , 9th • -                 | 1 7 44             | 3**<br>58<br> |
| ⊙ and )'s distance -                                                                      | •                         | 0 2 41             | 5             |
|                                                                                           | elative motion.           |                    |               |
| At Lanca \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \                                            |                           | • 57'<br>• 14 19   | _             |
| Relative motion -                                                                         | •                         | _ 13 22            | 26            |
|                                                                                           | В                         |                    |               |
|                                                                                           | ne due to distance.       |                    |               |
| Say As relative motion To one Savan day                                                   |                           | 13° 22′<br>- 60°   | 267           |
| So distance at midnight                                                                   |                           | . 2 41             | 5             |
| $\frac{60\times2^{\circ} \cdot 41^{\circ} \cdot 5^{\circ}}{13^{\circ} \cdot 22 \cdot 26}$ | g                         | <u> </u>           | 40°           |

After midnight at IAnca, which marks the true time of conjunction, and consequently the end End of the 30th of the 30th, or Amavasya Tidhi.

Tidhi.

| To express the same in Solar time, we l | 1276 | - | <b>-</b> + | 45 <sup>g</sup><br>12 <b>2 40</b> |
|-----------------------------------------|------|---|------------|-----------------------------------|
| Time after Sun rise on the 9th          | •    | • | -          | 57 2 40<br>60                     |
| The same before Sun rise on the 10th    |      |   | •          | 2 57 20                           |

#### CONCLUSION.

As the 29th Tidhi ended at 4°28° 50° after Sun rise, and the 30th on the same day at 57°2° 40°, it is manifest that the whole of the 30th or Amavasya Tidhi, was expended during the 9th of the Solar month Vyassei, and therefore, that it is a Cshaya, or expunged Tidhi. It is accordingly left out of the Panchangum; but its name and duration are inserted in the margin. (\*) There is, in consequence, no 30th Tidhi registered in the column for the month Vaisacha (page 67.) Hence also the Prathema Tidhi of the Lunar month Jaish'ta, falls on the 10th Vyassei, Civil account; for (as has been said in the note at the foot of page 114.) it falls truly on the 11th Sydereal day current, but as Vyassei commenced at night time, its Civil beginning fell one day later, and hence the 11th Sydereal is only the 10th Civil day of that month. (Vide Skeleton of Luni-solar Kalendar, ibid.)

The Cshaya Tidhi determined and left out of the columns of the Kalendar.

The case of the Adigah, or repeated Tidhi, being resolved precisely like that of the Cshaya, I Thesame process apshall not detain the reader by any further example.

plies to the resolution of the intercaln. ry days,

I shall now take leave of the Surriah Siddhanta, and enter on the consideration of the Vakiamor Solar process.



<sup>(\*)</sup> Oppadi or Cshaya Amavasya Tidhi 52g. 33v. 50p, the duration of that Tidhi being 57g. 2v. 40p,--4 28 50 **≈**52 33 50.

## PART II.

Of the Solar or Vakiam process.

In the first part of this Memoir we have explained the principles on which all Indian Kalendars which (like that of the Tellingas) rest on the doctrines of the Surriah Siddhania, are to be constructed. In the second we shall disclose the mechanism of the Solar Kalendar, which is much more extensively used in the Southern parts of India than the former, being that of all the countries where the Tamul language prevails.

The process of Selar Autonomy.

Both Kalendars contain precisely the same Astronomical and Astrological articles, the only difference being, that the Elements from which the Vakiam Rules and Tables are constructed, are extracted from the Ariah, instead of the Surriah Siddhanta; and that the mode of proceeding for resolving the different Problems is totally different.

This process was, I believe, the first that became known to Europeans; and considering the nature of its ostensible Elements, and how concealed the real ones lie in its Tables and formulæ from their original source, it is no wonder that the appearance of these, at the time of discovery, should have led, (even very scientific men) into the most extraordinary conjectures.

The most remarkable difference between the Vakiam process, and that of the Surriah Siddhanta, is, that the computations of the former are directly for the apparent, without previously obtaining the mean places of the Asters; and that these refer to the time of Sun rising, instead of mean midnight, as is directed in the Surriah Siddhanta.

In the Key to the Madhyama Saura mana we have given all that was necessary for the resolution of mean Solar, into European dates, therefore in the present division of the Kala Sankalita, we shall only attend to Luni-solar and Solar Hindu times.

The Elements of the Vakiam process being those of the Ariah Siddhanta, the Solar year consists of 365<sup>a</sup> 15<sup>s</sup> 31<sup>r</sup> 15<sup>p</sup> as was used in the Madhyama Saura mana (\*): the construction of

The primary Flements of the Vakiam and those of the Anah Siddhanta.

The Moon's Anomalistic Revolution is particularly noticed in the text, but in the Elements of the Yukiam it 19 taken to be 27d, 33g, 20v, Indian, and 27d, 13h, 20' European time.

<sup>(\*)</sup> According to that Sastra there are 1577917500 Bhumi Savan days (catled Yuga dina) in a Maha yug, being 323 days less than by the Surriah Siddhanta. The Solar year is therefore \(\frac{127217}{4320}\)\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\theta^2\]\[\frac{1}{2}\thet

that year is, therefore, to be used in the present process, instead of that which was given in the Skeleton for the Siddhanta Solar year 4924, at page 65; and the Roots of each of the 12 months, as well as the aggregate number of days in the concurring Lunations, will be,

| Names of<br>Solar months. | Types of Signs. | 1   | inni     | na<br>ngs | for<br>of | day<br>ea     |        | European dates of beginnings N. S. |         |         | Dom.<br>Letter. |     | Lunations. |          |          | gate       |    |           |
|---------------------------|-----------------|-----|----------|-----------|-----------|---------------|--------|------------------------------------|---------|---------|-----------------|-----|------------|----------|----------|------------|----|-----------|
| Poongoni 1 123            | ×               | D.  | с.<br>59 | v.<br>51  | г.<br>28  | Syde-<br>real | Civil. | 11                                 | Marcl   | ı 1822  | F               | İ   | 1          | D.<br>29 | с.<br>31 | v.<br>50   |    | g.<br>-10 |
| Chaitram 1424             | Υ               | (4) | 20       | 12        | 30        | 31            |        |                                    | April : | 1822    |                 |     | 2          | ı        | 3        |            | 11 |           |
| Vyassei                   |                 | (0) | 15       | 44        | 31        | 31            | , –    |                                    | May     |         | 1               |     | 3          | 1        |          | 30         |    |           |
| Auni                      | П               | (3) | 39       |           |           |               | 32     |                                    | June    |         |                 | !   | -1         | 118      | -        | 20         |    |           |
| $\Lambda$ ud $f i$        | 60              |     | 16       |           |           |               | 31     | t                                  | July    |         |                 |     |            | 117      |          | _          | _  |           |
| Auvani                    | $\aleph$        | (3) | 44       | 46        | 35        |               | 32     |                                    | Augus   |         |                 |     |            |          | 11       | -          | 31 | -         |
| Paratas <b>i</b>          | 쨏               | (6) |          | 56        |           |               | 31     |                                    | Septem  |         | 1               |     |            | 206      |          |            |    |           |
| Arpesi                    | ≏               | (2) |          | 18        |           | 31            | 30     |                                    | Octobe  |         | 1               |     |            | 236      |          | _          | -  | 20        |
| Cartiga                   | m               | (4) |          | 25        |           |               | 30     | i                                  | Novem   |         | 1               |     |            | 265      |          | _          |    | _         |
| Margali                   | 1               | (5) |          | 49        |           |               | 30     | 1                                  | Decem   | -       |                 |     |            | 295      | _        | _          |    |           |
| Tye                       | V9              |     | 59       |           | -         | 29            | 29     |                                    |         | ry 1823 | E               | 1 1 |            | 324      |          | _          | 2  |           |
| Maussi                    | 2.0             | (1) |          |           |           |               | 29     |                                    | Februa  |         | i               |     |            | 354      |          | _          | 8  | _         |
| Poongoni                  | ×               | (3) | 15       | 22        | 43        | 30            | 30     | 12                                 | March   |         |                 | _   | 13         | 383      | 53       | 5 <u>1</u> | 13 | -40       |
| Chaitram 4925             | r               | (5) | 35       | 43        | 45        | 30            | 31     | 11                                 | April   |         |                 |     |            |          |          |            |    |           |

N. B.—The Solar Ahargana may be found by means of Table XLVIII, part 2, of this collection, as follows:

|                                     |          |    |    |       |   | D.      | G.         | v. | P          |
|-------------------------------------|----------|----|----|-------|---|---------|------------|----|------------|
| for                                 | 4000378  |    | _  | -     | _ | 1461034 | 43         | 20 | 0          |
| •                                   | 900      | _  |    | -     | - | 328732  | 48         | 45 | 0          |
|                                     | 20       |    |    |       | - | 7305    | 10         | 25 | 0          |
|                                     | 3        | -  |    | -     | - | 1095    | <b>4</b> 6 | 33 | 45         |
|                                     |          |    |    |       |   | 1798168 | 29         | 3  | 4 <u>5</u> |
| Subtract                            | Sodhyam  | or | Eq | uatio | n | <br>2   | 8          | 51 | 15         |
| Solar Ahargana for the beginning of | Λ, С, 49 | 21 |    | -     | - | 1798166 | 20         | 12 | 30         |

Solar Ahargana beginning of 4924 of the Cali yeg.

With respect to the Luni-solar Ahargana, the Elements of the Ariah Siddhanta will give some difference from that which we found to proceed from those of the Surriah Siddhanta; but in this place, we can only account for that variation in a summary way. We shall, however, renew the full discussion of that subject in the Note where the method of resolving that Element by the Tables will be considered. \*)

<sup>(\*)</sup> The Rule for resolving the Luni-solar Ahargana is precisely the same as that used with the Elements of the Surriah Siddhanta: and therefore need not be repeated, but the same may be found with much less trouble by means of Table XLIX.

Luni solar Ahargana end of the year 1923 of the Call yeg, It will be seen in the marginal rote of the preceding page, that according to the Ariah Siddhanta, a mean Lunation is 29° 31° 50° 5° 40° &c. consequently that the Lunar year of 12 months consists of 354° 23° 1° 8° 2,6° &c. Now as we require the Luni-solar Ahargana for the end of the year 4823 of the Cali yug, it will be found that in this number of Solar years, there are 5074 Lunar years, and three Lunar months over, in all 60891 Lunar months, which, therefore, smultiplied by one mean Lunation gives 29° 22° 1° 5° 2,6° ×60891=1788146° [39° 21° 28° 53°

This Ahargana differs in appearance, one day from that resulting from the Elements of the Surriah Siddhanta, but in reality only 22° 24° 51° or 8° 57′ 56″ 24″ European time. It will be seen presently, that this variation is of no sort of importance, because the apparent position of the Sun and Moon elicited by any Ahargana and the Vakiam Tables will soon shew, whether the Asters be within one day of the conjunction, or not; and in the latter case, the Ahargana must yield to the circumstance, and be fitted to the proper time.

The Abargana of the Arich or Servich Sidohanta may be used indiscriminately,

`;

For the Soota dina, or feria of last conjunction, we have as usual 7)1798147(256878

with a remainder of \_\_\_\_\_\_ 1 to be counted from Thursday. The Soota dina therefore, falls on Friday, and as the following Saturday was formerly found to fall on the 12th of the Solar month Poongoui complete of A. Cali yugam 4923, this Friday falls on the 11th of the same month, (also complete) which means the time of San sising on the 12th.

## ARTICLE 1.

# Of the Elements and their construction.

The Sun and Moon's apparent places in the Hindu Zodiac for apparent time at Sun rising at Lanca, are to be obtained by means of the following Elements and process.

1º The Sun's place is determined by converting the number of months, days, guddias, viguddias, &c. into signs, bagahs, calas, and vicalas; being that measure of time which the

| Solar Ahurgana (0) | 1744548<br>53618       | Years,<br>2000<br>900<br>20<br>3 |                   | D.<br>1417-67<br>315930<br>7087<br>1063 | 55<br>17<br>20<br>6 | v.<br>36<br>0<br>22<br>3 | P.<br>13<br>39<br>40<br>24 | 8.<br>20.0<br>0.0<br>52.0<br>7,8 |
|--------------------|------------------------|----------------------------------|-------------------|-----------------------------------------|---------------------|--------------------------|----------------------------|----------------------------------|
| (1)                | 35436                  |                                  |                   |                                         |                     |                          |                            | <del></del> -                    |
| (2)                | 1815 <b>2</b><br>17713 | atercalations 2 100 (            | (0)<br>(1)<br>(2) | 17445-18<br>25436<br>17718              | 39<br>41<br>20      | 53<br>56                 | 57<br>24<br>42             | 19,8<br>20,0<br>10,0             |
| (3)                | 464<br>354             |                                  | (3)<br><b>(4)</b> | 354<br>88                               | 32<br>58            | 50<br>                   | 17                         | 2.6                              |
| (4)                | 110                    |                                  |                   | 1799146<br>+-1                          | [39                 | 24                       | 28                         | 53 <b>,0</b>                     |
|                    | 23                     | Luni-solar Ahargana sought       | -                 | 1798147                                 |                     |                          |                            |                                  |

Hindus, in a special sense, call Saura (\*). In this account, all days and fractions are always equal to one another, a sign corresponding to one month, a degree to a day, &c.

Generation of the Elements.

29 By equating (by means of a Table called Yoghiadi, the XXVIIth, 1st part, of this collection) the Arc so expressed, into that really gone through by the Sun in the same space of time; of which Table and operation a particular explanation follows.

The Sun's place at his rising at Lanca.

39 By finding the Sun's true motion from eight to eight days, or, approximatively, for every day by means of the same Table, part 1; and still more correctly by the second part thereof, if judged necessary.

His motion,

The Moon's apparent place is deduced for any proposed time, from her place at the beginning of the Cali yug. The rule includes at once her motion, and that of her Apogee; and the period when she completes a certain number of true Anomalistic revolutions in a known place of the Zodiac, affords means for finding how far, at any given time, she is advanced in a period of 248 days (called Devaram), which is taken to be equal to 9 of her Anomalistic revolutions; then, by help of another Table (the XXVIth of this collection), we know how much she takes to pass through each degree of her orbit, during the said period; and how far she is advanced at the proposed time in the Hindu Zodiac.

The Moon's place for the same instant.

On calculating the number of Anomalistic revolutions which have occurred from the origin of the Cali yug, to any assigned period, the Hindu Astronomers have determined that there were exactly 3785 Anomalistic revolutions of the Moon in 105052 mean Tidhis; from which they concluded that there were 27,0926024 mean Tidhis in one revolution; and as the mean Tidhi is to the Bhumi Savan day as  $\frac{50g 3v 38p}{60}$ , they concluded  $27^d$ ,354000, or  $27^d$  33° 16° 33°,62 in natural days for the same. The period, however, which is used in the Vakiam process, differs a little from the above; being  $27^d$  33° 20°; i. e. 3° 26°,38, or in European time 1′ 22″,4 &c. longer.

Anomalistic revolu-

The Moon's apparent place at Sun rise on any day at Lanca, is to be determined by means of five Elements, called *Vedam*; Raza Gherica; Calunilam; Devaram; and Chandra Vakiam Dhurmavanham: which are generated as follows.

The Elements for the Moon's apparent place, referred to Sun rising at Lanca.

### 10 The Devaram.

Multiply one Anomalistic revolution of the Moon, 27d 33s 20', by 9, and you have 218 days without a remainder, called a *Devaram*, when the Moon's place in Apogee is 0' 27' 44' 6" from the beginning of the Solar Sydereal Zodiac.

The Devaragi.

<sup>(\*)</sup> Vide Glossary at the end.

| 20 | The | Calanilam. |
|----|-----|------------|
|    |     |            |

| Calanilam,    | Multiply one Devaran or       | 218', by 12, a         | nd you ha   | re       | . :           | 2976        | 5 <b>4</b>                |
|---------------|-------------------------------|------------------------|-------------|----------|---------------|-------------|---------------------------|
|               | Add two Anomalistic revolu    | ations of the          | D,          | -        | •             | 55          | 6 40                      |
|               |                               | A Calani               | la <b>m</b> | •        | •             | 3031        | [6 40                     |
|               | neglect the fraction; and the | Moon's place i         | lu Apogee   | is 11.7  | 7° 31′ 1″. (1 | <b>'</b> )  |                           |
|               |                               | 3º The                 | Raza G      | herica.  |               |             |                           |
| Raza Gherica, | Multiply one Calanilam, or    | r 3031', by 4,         | and you l   | have     | •             | •           | 121244                    |
|               | Add one Devaram               |                        | -           | -        | •             | •           | 218                       |
|               |                               | A Raza (               | Gherica -   | •        | •             | •           | 12372                     |
|               | and the Moon in Apogee is 9'  | 27' 48' 10'.           |             |          |               |             |                           |
|               |                               | 42                     | Tl e Veda   | m.       |               |             |                           |
| Yedan.        | Multiply one Anomalistic re   | volution or 27'        | 33:20,1     | y 3, 21  | al you have   | . 2         | <b>!</b> 0⁴               |
|               | Multiply one Devaram or 2     | .48', by 7             | •           | -        |               | 17          | 36                        |
|               | Add one Calarilam             |                        | -           | -        |               | <b>3</b> 0: | 31                        |
|               | Multiply one Raza Gherica     | or 12 <b>3</b> 721, hy | 129         | •        | -             | 159598      | 33                        |
|               | Add 1 of Moon's Anomali       | stic revolution,       | neglectin   | ig the f | raction       | •           | 9 [11 6 40                |
|               | The sum is a Vedan            | ı                      | •           | _        | •             | 16005       | <del></del><br>8 <b>4</b> |
|               | and the Moon's place in Apog  | re is 7' 2° 0' 7       | ·*.         |          |               |             |                           |
|               | T . 1 . 4                     |                        |             |          |               |             |                           |

Let these four Elements be arranged in the inverse order from that in which il ey were generated.

| A 77 1         | Number of Days. | Place of | the M | oon i | n Apegee. |  |
|----------------|-----------------|----------|-------|-------|-----------|--|
| One Vedam      | 1600884         |          | ઈ•    |       |           |  |
| , Raza Gherica | 12372           | 9        | 27    | 48    | 10        |  |
| ,, Cilani'am   | <b>3</b> -31    | 11       | 7     | 31    | 1         |  |
| ,, Devalum     | 248             | 0        | 27    | 41    | 6         |  |

The Chandra Va'ci-

To deduce the Chandra Vakiam Dhurmavanham, (which is the fifth Element of the Solar process) from the four preceding ones, it is supposed that the Solar and Luni-solar Aharganas, are previously known. Taking t ese as data, we have the following,

I could obtain no information on the reasons which have rendered the subtraction of that quantity necessary for having the Moon's true place at the end of a Vedam,

<sup>(\*)</sup> There are two features are trainly neglected in the construction of these Lifenents, viz. 6g. 40v. in the Calanilam, which produce a difference of 26g. 4v (in minu) in the R-za Gherica. In the Vedam, the neglecting of this fraction, together with 11g 6v. 1f p. on the third part of one Anomalistic revolution, will produce a very considerable Equation. Thus, on 1 Calanilam - 0.1 6g 40v 0p

On 1.9 finz i Ghericas - 57 20 0 0

On 1.8d or 1 Anom. Revolution - 0.11 6 40

Two Anomalistic Revolutions 2×27d, 33g, 20v. - 55 6 40 0

D fference on one Vedam. 2 Anomalistic Revolutions - + 2 31 6 40

#### PRECEPT.

## For the Argument of the Moon's Equation.

- "Divide successively the Luni-solar Ahargana by 1 Vedam, 1 Raza Gherica, 1 Calanilam and Precept.
- 6 1 Doraram, the remainder in days will be the Chandra Vakiam Dhurmavanham, which is the
- 66 Argument of Table XXVI, both for the Moon's true place and motion."

# Elements for the Sun's Apparent place.

#### PRECEPT.

- " 10 Convert the number of months and days elapsed since the beginning of Chaitram T,
- the former into the numeral of the last Sign gone through by the Sun, the latter into degrees,
- " which will answer to the time expired at the end of the proposed day.
  - " 20 If the month (whatever be the day computed for pinding its duration) begins at day
- " time, ded of the guidding as cales, which had elapsed between Sun rise and the time of his
- " entering a new Sign; the remainder will give his Saura place on the morning of the day on
- " which the Sydered month commenced.
- "So If the month begins at night time, add the guddias as calas which are wanting to come plete the night and begin the next day.
- " 4: To find the Son's Equation for one day by means of the Yoghiadi Table, divide by 8
- the quantity given therein for the day itself; or (if it be not in the Table) for that nearest
- 66 below it, and the quotient will be the Equation of the Sun's true motion to 1° in a day, sup-
- " posed to be his true progress during 8 days.
- 66 50 Multiply the Equation thus found by the number of days you require in the interval of 8 days, and the product will be the Equation required.
- 66 Co The Equations so obtained are additive from the beginning of Arpesi to the end of
- Maussi, and subtra tive from the beginning of Poongoni to the end of Paratasi."

As the preceding precepts are insufficient for a clear understanding and application of Table XXV:I, the following article is intended for giving the reader a more distinct view of its construction.

#### ARTICLE 2.

### Account of the Vakian Talles.

19 Of the Chandra Phala and Sputa Gati Table, being the first of the Vakiam process and the XXVIth of this collection.

Of the Chardes Pasala and Spatz Gail Table.

The Argument of this T: 1 is the Chandra Vakiam Dhurmavanham, or the remainder in days of the Ahargana, after division by the four Elements above described, 248 of these (equal to one Devaram) are registered in the first column.

The second column contains the Chan 'ra P hals, or Moon's Equation, always to be added to her Druva, and the third gives her true motion for each Validan day.

The Moen's Forgationalways adultive.

Elements for the Son's apparent place.

Precept.

The same always taken, for the Vakiam day found by the operation.

The Moon's motion to be taken for the next day when the conjunction is to come, or the Irdhi energy.

The same to be taken for the day itself when the conjunction is passed, or the Trahi beginning. The Equation is in all cases to be taken for the Vakiam day itself, such as indicated by the operation: but the Moon's true motion may be taken for that or the next day, according to the following rule.

If by the result of the operation it appears that the conjunction has not yet occurred, or (if during the course of the Lunar month) that the Tidhi is at, or near its end, then the Chandra Gati, or true motion, is to be taken for the next day to that indicated by the Vakiam (or Argument).

But if at the time of Sun rising it appeared from the Sun and Moon's Longitudes that the conjunction had passed over, or that more than one half of the Tidhi was expended, then in such a case, the Moon's true motion is to be taken as given in the Table for the day itself.

The Moon's mean motion, to which her true one is referred in Table XXVI, is 791 calas, or 13° 11' per diem.

Account of the Yoghiadi Table, being the second of the Vakiam process and the XXVIIIA of this collection.

#### OF PART FIRST.

1st Part of the Yoghiadi Table.

The account which was originally given to me of this Table was so very unsatisfactory, that it was a long time before I could understand its right application.

Independently of the precept which we have delivered in the preceding pages, it is to be understood that the calas or minutes given in the 4th column opposite to any day of the month in the division of which it is registered, represents the Equation of the Sun's motion in plus or minus to 1° for each day, for eight consecutive days. So that if opposite to the 1st day in the month Chaitram we find 11 calas, we are to understand that so many minutes will be the complete Equation due on the eighth complete day of the said month.

These 11 calas divided by 8, give a quotient of 1' 22" 30", which is the mean daily Equation used by common computers from the 1st to the 8th Chaitram complete.

But on the 9th day this Equation varies, for by the Table it gives 14 calas, meaning the aggregate Equation from the 8th to the 16th, both complete. During that interval the daily Equation will therefore be 1-8th of 14' or 1' 45"; and if we want that due to the 9th, it will be 11+1' 45"=12' 45", the second member being added because the calas are increasing; but the whole Equation is subtractive, on account of the Sign — expressed in the column of months. Proceeding in the same manner, we shall find the Equation for the 16th Chaitram complete, to be 11'+14'=25' also subtractive.

Lastly, if the month Chaitram of the proposed year happened to be of 32 days and the Equation for its last day were required, we would add 11'+14'+16+17' (those due to 1st, 9th, 17th, 25th days,)=58' for the quantity sought.

The Moon's true motion referred to 1° to a day, But then on the ensuing day, because the Sun would enter a new Sign, all the foregoing Equations would be abandoned, and if it happened to enter the Sign Vrisha & at it's rising (which very rarely occurs), the Equation for that instant would be Zero. I shall illustrate the foregoing exposition by a few Examples.

The Equation equal to 0, when the Sun enters a new Sign at his rising.

#### EXAMPLE I.

Let it be required to find the Sun's apparent place on the 15th Chaitram of the 4924th year of the Cali yeg current, at his rising at Lanca.

The Suu's place for 15th Chaitram A. C. 4924.

On the 1st Chaitram the Sun entered the Sign Mesha  $\gamma$  at 20° 12° 30° after Sun rise (1st General Table), then

| ⊙'s place, 1st Chaitram<br>For 15 days complete | ,         | ~ -                 | 0° | 0°<br>15 |    | 0"<br>0 |
|-------------------------------------------------|-----------|---------------------|----|----------|----|---------|
| But as at his rising he was still in the S      |           |                     | 0  | 15       | 0  | 0       |
| we are to deduct the guddias as cula            | s 10r 20° | 12, 30 <sub>6</sub> | •  |          | 50 | 13      |
| ⊙'s Saura place, 15th Chaitram                  |           | •                   | 0  | 14       | 39 | 47      |

To find his Equation, the Yoghiadi Table gives for 8 days complete 11 calas, we want therefore for 7 days more; and finding 14' for 9th Chaitram, the 1-8th part of that quantity or 1' 45" is the daily Equation from the 8th to the 16th complete: therefore  $7 \times 1'$  45"  $\pm 12'$  15", is the Arc to be added to 11 calas, before found; the sum amounting to 23' 15".

But we have retrenched from the Sun's Saura place 20' 13", on account of 20 guddias, 13 vig. (nearly), in the ratio of which we are to decrease the above Equation.

Now having found that the daily Equation from the 9th to 17th beginning, was 1' 45".

| Say: $60^{3}$ : $1'$ $45''$ :: $20^{3}$ $13'$ : $35''$ and | - | • | 23′ 15″<br>35      |
|------------------------------------------------------------|---|---|--------------------|
| Corrected Equation                                         |   |   | 22 40<br>14° 39 47 |
| His Sputa Graha or true place sought                       | ~ | ~ | 14 17 7            |

#### EXAMPLE II.

The same for the 24th Audi complete of the 5724th year of the Cali yug.

The Sun's place 24th Audi 3741.

Let us take for data, that the Sun entered the Sign Carcata so on the 1st Audi of the proposed year, at - 51° 34° 33°

|                                                                                                 | £ | • | •  |   | 50       | ∪ <b>‡</b> . | 3. <b>3</b> ° |
|-------------------------------------------------------------------------------------------------|---|---|----|---|----------|--------------|---------------|
| After Sun rise-remains of the day                                                               |   | ~ | •  | - | 8        | 25           | 27            |
| Proceeding as before, say, 1st Audi<br>For 24 days complete<br>For the time wanting to Sun rise | • | • | •. |   | 24<br>0, | 0′<br>0<br>8 | 0"<br>0<br>25 |
| ⊙'s Saura place, 24th Audi                                                                      | - | • | •  | 3 | 21       | 8            | 25            |

The Table XXVII, part 1, for 8 days in Audi gives 21'; for 16', 23'; for 21', 22', and in the present case, as the Equation is required exactly for 24 days, all these calas being added together give 69' for part of the Equation sought.

But we have added, for S' 25' 27' that remained of the day, an Arc of 8' 25' to the Sun's Saura place; the Equation must therefore be increased in ratio to the same.

As on the 24th Audi complete it was 22'; 1.8th thereof is 2' 45", the daily Equation from the 17th to the 25th.

| Say therefore: 60°: 2' 1  | 5" :: 8g 25 <b>v</b> | 22p : | • |   |      | + 22 |
|---------------------------|----------------------|-------|---|---|------|------|
| Equation above found      |                      | -     | • | • | 1    | 9 0  |
| Corrected Equation        | -                    | •     | • |   | 1    | 9 22 |
| ⊙'s Saura place, 24th Aud | li complete          | •     | • |   | 3 24 | 8 25 |
| Sun's Sputa Graha sought  | -                    | •     | • | - | 3 22 | 59 3 |

How to compute the Sun's true diarnal motion,

These two Examples will suffice to show, how the Sun's Sunra place may in all cases be equated to his true one. There remains now to explain, how the Sun's daily motion is to be computed by means of the same Table, which however, has been in a great measure explained in the preceding article; for the mean daily motion for 8 days is obtained by dividing by 8, the calas registered opposite to the day next below the proposed one, the quotient being the Equation  $\pm$  to be applied to 60' for obtaining his true motion on the same day.

#### EXAMPLE 1.

Wanted the Sun's true motion on the 15th Chaitram 4921.

From Table XXVII, part 1, take the calas opposite to the 9th Chaitram, which are 14; 1-8th of which, 1' 45', is the Equation from the 9th to the 17th, being subtractive.

|                                  |   |   |   | G-1   |
|----------------------------------|---|---|---|-------|
|                                  |   |   |   | 1 45  |
| Uncorrected Sun's diarnal motion | • | ~ | - | 58 15 |
|                                  |   |   |   |       |

and by the common Tamul Kalendar makers, this quantity is used indiscriminately as the true motion on any day during that interval.

Second differences of the Sun's diamal motion.

But the few who aim at greater accuracy, take the second differences,—seldom, it is true, for equating the Sun's Saura to his true place, but frequently for finding his true motion on any specific day, the process of which is as follows:

Take the calas for the ensuing eight days, which in the present case will be those for the 17th

| Chaitram, viz. 16'; I-8th of which is                    |                  | 2              | ′ 0 <b>″</b> |
|----------------------------------------------------------|------------------|----------------|--------------|
| Equation for the 9th, as above found                     |                  | . 1            | 45           |
|                                                          | Difference       |                | 15           |
| then 8': 15": 64: 11" 22" S.c. which as the calas are in | creasing, add to | 1              | 45           |
|                                                          | -                | -              | 11 22        |
| Corrected Equation                                       | •                | - 1            | 56 22        |
| Which subtract from                                      | 70- tu           | 60             |              |
| O's true motion on the 15th Chaitram                     |                  | <br>5 <b>8</b> | 3 33         |
| N. B In Table XXVIII that Equation is                    |                  | 58             | 8            |
|                                                          | Difference       | <del></del>    | 4 22         |

on the 17th as the calas are 16', the Equation would be 2' and the Sun's motion exactly 53'.

#### OBSERVATION.

It is manifest that these corrections are equally applicable to the Equations for reducing the Sun's Saura to his true place; and it may appear singular that, whereas in equating the Sun's Longitude, the Tamul computers never omit to take into consideration that fraction of the day which marks the interval between Sun rising, and his entrance into a new Sign (whatever be the day of the month computed for) yet when calculating the Sun and Moon's distance and relative motion, they should entirely overlook these second differences.

## Of the second Part of Table XXVII.

This part serves to find the Sun's Anomalistic Equation, and consequently the Solar and Lunisolar Arca Bhagábalas, and the Sun's true motion for every day in the year, much more accurately than the first. Its Epoch is the beginning of the 4941st year of the Cali yuz, answering to the 11th April 1839, when the place of the Sun's Apogee will be in 2° 17° 17′ 20″.

2d Part of the You garadi Tuble.

Its Fpoch A C. 4940 complete A, D, 1859.

This quantity, which is to be found at the head of the fifth column, is the Supplement of the Sun's Anomaly to a complete Circle, on the 1st Chaitram, at the precise time when he will enter the Sign Mesha; and is therefore the Argument of his Equation for that day. The following quantities are the same for the beginning of the succeeding Solar months; but in using these, the positive and negative Signs must be taken as given in this Table, and not as exhibited in Tables XXII and XXIV, because the Argument of the former is always the Supplement of the Sun's Anomaly; and of the latter, the Anomaly itself; whereas in the 2d part of Table XXVII, it is either the one or the other, or their respective Bhujahs to the Sun's Apogee or Perigee, conformably to the rules of the Sastras, a construction which saves the possibility of error.

The Surve true mo . tion referred to his mean dlu aul motion or 59' o'.

The Sun's true progress is referred, in this second part, to his mean motion, or 59' 8", and not to 60', as in the first. The positive and negative Signs in the 7th column, indicate when the apparent is greater or less than the mean motion, following the same order as in part 1st, which however, has not the advantage of shewing the precise day when the Signs change.

I shall now proceed to give some examples of the application of this Table: but it is to be understood that, neither its first nor second part can be considered as affording results strictly correct, for I cannot find that any part of the Vakiam process can pretend to more than furrishing approximations, the limits of which, when compared to the resolutions by the Surriah Siddhanta modified by the Tikas, are by no means narrow.

## Example I.

The Sin's true motimi and Ama Elegabila for the 15th Charcam 4941.

Let the Sun's Equation, true motion, and Solar, as well as Luni-solar Arca Bhagábala, be required for the 15th Chaitram of the 49 list year of the Cali yug.

10 The Argument of the Sun's Equation for the 1st Chaitram, by Table

which motion is to be subtracted, because the Argument is decreasing in the fourth quadrant of Anomaly.

20 With 62° 30' 17" as an Argument, refer to either Tables XXII or XXIV (but in preference the latter, because it gives the Equation for every degree), and the Ravi P'hala will be found 1° 56' 4", which is to be taken as positive on account of the sign + in Table XXVII, part 2.

The same Argument will give the difference between the true and mean daily

|                                     |   |      | $\mathbf{D}$ : | eren <b>ce</b> |    | 1   |
|-------------------------------------|---|------|----------------|----------------|----|-----|
| N. B.—The same by the Table XXVIII  | • |      | -              | •              | 58 | 8   |
| ⊙'s true motion, 15th Chaitram 4911 | ~ | ( du | -              | -              | 58 | 9   |
|                                     |   |      |                |                | 59 | 8   |
| metion of the Sun                   |   | -    | •              |                |    | 59" |

The Solar and Lunar Arca Bhagabala will be found as usual, viz.

The D's 
$$-\frac{1^{\circ} 56' 4''}{365} = +19''$$
The D's  $-\frac{1 56 4}{27} = +4' 17''$ 

but the Sun's is not used in the Vakiam process.

ENAMPLE II.

The same for the 20th of Audi of the same year. The same for 20th

Aud: 1911.

| The Manda Kendra, or Argument for                          | or 1st Audi, colu | mn 5th, is       | . 0' 12' 49                 | 2' 40°         |                  |
|------------------------------------------------------------|-------------------|------------------|-----------------------------|----------------|------------------|
| Add Sun's motion for 20 days, becar                        | use the Argumen   | it is increasing | 5                           |                |                  |
| in the 1st quadrant                                        |                   | -                | 19 49                       | . 43           |                  |
| Argument, 20th Audi                                        | •                 |                  | 1 2 2                       | 5 23           |                  |
|                                                            |                   | or               | <b>3</b> 2° 25              | 5′ 2 <b>3″</b> |                  |
| The Equation answering to which is                         | 3 -               |                  | - 1 10                      | 47             |                  |
| Difference between O's true and m                          | ean motion        |                  | <b></b> 1                   | 53             |                  |
| ⊙'s true motion, 20th Audi                                 | . •               | •                | 59                          | 15             |                  |
| N. B The same by Table XXVII                               | ı <b>ı</b> , .    | •                |                             | 14             |                  |
| ⊙'s Arca Bhagábala                                         | 11"               | Difference       |                             |                |                  |
| D's do.                                                    | <b> 2</b> 37      |                  |                             |                |                  |
|                                                            | Example III       | ſ <b>.</b>       |                             |                |                  |
| The same for the 18th Paratasi of the                      |                   | •                |                             |                |                  |
| Argument, 1st Paratasi, colu                               | •                 |                  | 2° 12° 42                   | 2′ 40″         | The same for the |
| O's mean motion for 18 days                                |                   |                  | 17 44                       |                | 18th Paratasi.   |
| To be added because the Arg                                | ,                 | in the 1st qua   |                             |                |                  |
| diant of Anomaly                                           |                   |                  | 3 0 27                      | 16             |                  |
|                                                            |                   | Equation         | <b>—</b> 2' 10              |                |                  |
| 1-365th of which is                                        | the O's Arca Bl   | _                | 2 10                        | 21             |                  |
| 1.27th the Lunar A                                         |                   |                  | = -4                        |                |                  |
| Equation of true to mean mo                                | _                 |                  | <u>-</u>                    | 0              |                  |
| True motion, 18th Paratasi                                 |                   | •                | • 59                        |                |                  |
| which is the same as that given in Tabl                    | le XXVIII.        |                  |                             |                |                  |
| •                                                          | EXAMPLE IV.       |                  |                             |                |                  |
| The same for the 10th Man, all full                        |                   |                  |                             |                |                  |
| The same for the 18th Margali of the Argument, 1st Margali | e same year.      |                  | <b>AL 199 1</b> 77          | ( 20           | The same for the |
| O's mean motion for 18 days                                |                   |                  | 0 17 17                     |                | ISth Margali.    |
| Of which take the difference                               | •                 | • +              | $\frac{17}{0} \frac{44}{0}$ |                | •                |
| The Equation answering to the                              | his Argument      |                  |                             | 23*            |                  |
| O's Arca Bhagábala insensibl                               | •                 |                  | • •                         | 20             |                  |
| Equation of O's true to mear                               |                   | -                | - + 2'                      | 18"            |                  |
| 224                                                        |                   |                  | 59                          | 8              |                  |
| O's true motion on the 18th                                | Margali, which is | s at its maxim   |                             | 26             |                  |
| <u> </u>                                                   | ,                 |                  |                             | III the same.  |                  |
|                                                            |                   | Σ,               |                             | the same       |                  |

These operations are so obvious, that it would be a waste of time to carry them any further. They leave little doubt in my mind that Table XXVIII (which was communicated to me by a Native Astronomer) was computed by means of the 2d part of Table XXVII, though in some instances I have found a few seconds of difference.

N. B.—As the Sun's Apogee is supposed to move at the rate of 1' in 517 years, the latter Table may easily be fitted to any remote Epoch, by a common rule of proportion, all the Arguments being equally affected by its motion.

## Of Table XXVIII.

Of Tible XXVIII, being the 3d of the Vakiam process.

This Table furnishes the Sun's true diurnal motion for every day in the year, and therefore requires no particular explanation. I suspect it to have been constructed by the person who communicated it to me, by means of the 2d part of Table XXVII. Be this as it may, as it saves the trouble of computing the Sun's true diurnal motion by either of the processes which we have formerly explained, I have thought it deserving to be inserted in this collection.

Table XXVIII, as well as the preceding one, supposes the Sun's Apogee in 2°17°17′20°, and on account of the slowness of its motion, will be sufficiently true for a great number of years.

# Of Table XLIII. (\*)

Of Table XLVII, being the 4th of the Vakiam process. I profess to understand very imperfectly the construction of this Table, which was communicated to me by a Native Kalendar maker named Sami Nada Sashya, who made all his computations with shells and tamarind seeds, but who, (though he used it constantly), could not give me the least account of the theories on which it was grounded.

There can be no doubt, however, both from the name given to the quantities registered in the 2d column, and from the manner of using it, that it accounts for the effects of the difference of Longitude on the Moon's apparent motion, between Lanca and some other place (†), which Sami Nada believed to be Tanjore, but in my opinion Trivalore, because that place lies not far from it, and is still reputed to be the seat of the sciences in these Southern parts of the Peninsula.

This Table, I was informed from the same source, is used indiscriminately for all places between Cape Comorin and Madias, though my informer acknowledged it would not do for Mulasyan; by which he meant the Coast of Malabar. The lateness of the Epoch when this Table fell into my hands, prevented the possibility of my analyzing it as I could have wished: I am, therefore, compelled to confine myself to a more explanation of its application, which I shall do in a solitary example; for a lits results are confined to one particular spot, and as the

<sup>(\*)</sup> The arrangement of the Tables having accidentally been disturbed, the present one, which should have been the XXIXth, is the XLVIIth, of this collection.

<sup>(†)</sup> The Sangscrete word for Terrestrial Longitude is Desentara; and for the Celestial Sayana.

object of the present research is general, I shall, in the remainder of what I have to say on the Vakiam process, have recourse to those general methods, which though more operose, may be applied to any geographical position on the globe.

The Equations furnished by the Table under consideration (which is the 4th of the Vakiam process) are to be applied to the Moon's uncorrected place, such as it has been elicited by her Druva, and Chandra Vakiam Phala.

The Desentara calas or minutes, registered in the second column, are always additive, and to be taken for the month which precedes that for which the computation is made.

Application of the Description calas.

The Andra vicalas, or old seconds, registered in the third column, are for any day in the month itself that the computation is made for. They are to be used as multiples of the old degrees, minutes and seconds of the Sun's true place, at Sun rising on the proposed day; the product of the degrees giving vicalas, or seconds; that of the minutes, turparies or thirds, and so forth, which implies a division by 60°.

Of the Andra vie

This latter Equation is to be applied + to the Moon's uncorrected place, as indicated in the Table.

#### EXAMPLE.

| Let the Sun's apparent place on the 24th Audi o    | complete, be        |         | -                   | 3°       | 22° | 5 <b>9</b> ′ | 3∕ |
|----------------------------------------------------|---------------------|---------|---------------------|----------|-----|--------------|----|
| And the Moon's uncorrected place at the same i     | instan <b>t .</b>   | •       | -                   | 4        | 3   | 57           | 13 |
| 10 Add the Desentara calas for Auni II,            | •                   | -       | -                   |          | +   | 7            | 0  |
| 2º The Andra vicalas, for any day in Audi &        | (the month <b>c</b> | ompute  | d in) ar            | e        |     |              |    |
| 4- 2", and the odd degrees, minutes, &c. of the Su | n's Longitud        | le - 22 | 59′ 3               | *        |     |              |    |
|                                                    | Multip!             | y by    | × 2                 | <b>,</b> |     |              |    |
|                                                    | Equati              | on 45   | * 53 <sup>#</sup> ( | )*/      |     |              |    |
| And on account of the 58" say                      | •                   | •       | •                   | •        |     | +            | 46 |
| )'s place corrected for Desentara, 21th Audi       | 45                  | •       | ~                   | 4        | 4   | 4            | 59 |

Moon's place un-

There is a last Equation used by the Tamul Kolendar makers, of which Sami Nada could give me no other account, but that it was indispensable, and which I believe answers to the Arca Bhagábala, though the process for eliciting it, hears not the least resemblance to any of the methods that we have hitherto seen.

Of the Equation due to the difference between the Moon's true and mean motion.

Second correction supposed to answer to the Moon's Arca Bhagábala.

Difference of Moon's true and mean motions.

Difference 53

An Equation of 32# per Devaram,

Resolution of 2d correction.

Now for each *Devaram* the precept directs an Equation of 32 tarparies or thirds; therefore  $9 \times 32^n = 238^m$ , which product multiply by as many units as there are in the difference of the Moon's apparent and mean motion, and this second product, which amounts to  $288^m \times 53 = 4'$  14' 24'', is to be applied  $\pm$  to the Moon's place once corrected, as her *true* is greater than her mean motion; and *vice versa*.

Mor's place twice corrected,

In the present case it will therefore be

| )'s place once corr  | rected | • | • | • | 4' | 4* | 4 | 59* |
|----------------------|--------|---|---|---|----|----|---|-----|
| Add Equation         | •      | • | • |   | +  |    | 4 | 14  |
|                      |        |   |   |   |    |    |   |     |
| )'s place twice corn | rected | • | - |   | 4  | 4  | 9 | 13  |

supposed to be her Sputa Graha, or apparent place at the instant of Sun vising on the 25th of Audi, at the place computed for.

#### ARTICLE 3.

Resolution of the last conjunction of the year 4923 of the Cali yug, reduced to a given Meridian.

Resolution of the Amavasya which ended the 4923d Luni-solar year of the Cali yug, called Brisya; and preceded the commencement of the 4924th called Chitrabhanu, reduced to the Meridian of Trivalore, as is supposed.

#### A

We have found at pages 119 and 120, that the Solar and Luni-solar Aharganas, with the respective Soota dina for the end of the 4923d year of the Cali yug, were,

| Calas Alassas to Cl. to 100 to    |   |   | D. G. V. P.      |
|-----------------------------------|---|---|------------------|
| Solar Ahargana, 1st Chaitram 4924 | - | - | 1798166 20 12 30 |
| Luni-solar do. 30th Phalguna 4923 |   |   | 1793147          |
| The Solar Soota dina consequently | • | - | Thursday.        |
| The Luni-solar do.                | - | - | Friday.          |
|                                   |   |   |                  |

1º Divide the Lunar Ahargana successively by - 1 Vedam 1600984 1778147(1

| 1 Raza Gherica    | • | •, | Ţ | ÷ | 12372)197163(15<br>12372 |
|-------------------|---|----|---|---|--------------------------|
|                   |   | i. |   |   | 73443<br>61860           |
| 1 Calanilam       |   | *  | • | * | 3031)11583(3<br>9093     |
| 1 Devaram         | • | -  | ÷ | - | 248)2490(10<br>248       |
| dra Vakiam Dhurma |   |    |   | • | . 10                     |

the Argument of Table XXVI.

Chan

<sup>20</sup> Multiply the analogous Longitudes by the respective quotients; viz.

| 1 Vedam      |     |      | _   | 7°   | ల్త్ | 0'     | 7"   | ×    | 1    |            | _ | 7' | 2• | 0' | 7# |
|--------------|-----|------|-----|------|------|--------|------|------|------|------------|---|----|----|----|----|
| Raza Gherica |     |      |     |      |      |        |      |      |      | •          | - | 4  | 27 | 2  | 30 |
| Calandam     |     |      |     | 11   |      |        |      |      |      | _          | - | 9  | 22 | 33 | 3  |
| Devaram      | -   |      | ~   | 0    | 27   | 44     | 6    | ×    | 10   | -          | - | 9  | 7  | 21 | 0  |
|              |     |      |     |      | 7    | ) 's [ | Druv | a    | -    | -          | - | 6  | 28 | 56 | 40 |
| Equation for | C   | hand | lra | Vak  | iam  | 10 (   | Tab  | le I | XXVI | ) <b>-</b> | - | 4  | 7  | 58 | 0  |
| Meon's place | ט פ | nco  | rr€ | cted |      | -      |      | •    | -    |            | - | 11 | 6  | 54 | 40 |

Moon's place uncorrected.

at the time of Sun rising at Lanca, on the 11th Poongoni ending, or 12th commencing; to be rectified hereafter.

В

### For the Sun's place.

We find by the Solar Ahargana given at Article A, that the Sun entered the Sign Mesha Y when there had expired since the beginning of the Cali yug - 1798166° 20° 12° Subtract abstract duration of the month Poongoni, Table III, \_\_ 30

> 59 51 28

Ahargana 1st Poongont 4923

Ahargana, 1st Poongoni 4923 1798135

which shows that the Sun entered the Sign Min X at night time; and that there remained to complete the night, and begin the day (60s - 59s 51' 28°) 0s 8' 32°; which according to the precept delivered at page 123, article 3°, are to be added as vicalus and turparies to the signs and degrees of his Lougitude, in order to have that Element precisely for the time of his rising. Then to proceed,

| Sun's Saura place, 1st | Poongoni | • | -          | - | 11° 0° | 0′ | 0, |
|------------------------|----------|---|------------|---|--------|----|----|
| For 11 days complete   | -        | - | . <b>-</b> | - | 11     | 0  | 0  |
| Add for 8' 32', or say | 9, -     | - | -          | - |        |    | 9  |

Sun's place uncorrected.

O's Saura place on the 12th Poongoni at his rising at Lanca 11 11

which to reduce to his apparent Sydereal place according to the precepts delivered at pages 119 and 120, we have by Table XXVII, part 1st, for the first 8 days in Poongoni - 2'; for the ensuing 8 days (from the 9th to the 17th) = 4'; and  $\frac{4}{8} = 30'$  for one day; and from the 8th to the 11th there being 3 days, say 3×30"=1' 30"; which added to 2', gives - 3' 30" for the Equation sought; and as only 9" were added to the Sun's Saura place on account of what remained of the night when the Sun entered the Sign Min X, the second Equation adverted to at page 125, para. 3, is insensible. Hence

| O's Saura place above for | ınd    | -           |        | •        | 11'  | 11 | 0'  | -9 <b>#</b> |
|---------------------------|--------|-------------|--------|----------|------|----|-----|-------------|
| ***                       | -      |             | -      |          |      | —  | 3   | 30          |
| 'S Sputa Graha, or appa   | reut r | Jace at Sun | rising | at Lanca | . —— |    |     |             |
| on the 12th Poongoni 2    | C      | 1039 (*)    | 55     | -        |      | 10 | - 0 |             |

Sun's place correct-

on the 12th Poongoni A. C. 4923. (\*)

<sup>(\*)</sup> As far as this step, the rule is the same whether we work for the Arca Bhagabala by the 2d part of Table XXVII, or by the rule delivered at page 125, or if we mean to find the San's true motion on the dry computed for by Tible XXVII or XXVIII, because these Elements have nothing to do with the preceding part of the operation.

To correct the Moon's place for the Desentura and other Equations.

Reductions to the Longitude.

By Table XLVII, the Desentura calas for the month preceding that of Poongoni (page 131) i. e. Maussi, are +26'.

The Andra vicales by the same Table for Poongoni itself are - 10"; and the odd degrees. minutes, &c. of the O's Longitude are 10° 56′ 397 Which according to precent multiply by \_\_ 1' 49" 20" 109" 20" 30"

For the last Equation (page 125), the Moon's true motion due to Vakiam 10, Table XXVI, is 829': but the Sun's apparent place is 11' 10' 56' 37" And the Moon's (uncorrected) \_ 11 6 54 6 which shows that on the 12th at Sun rising, the conjunction had not occurred; therefore by precept, page 124, her motion is to be taken for the next Vakiam day, viz. 11, the motion for which is 840' D's mean motion Difference

Last Equation an. swering to the Arca Bhagábala.

But the operation (page 132) shewed 10 Devarams in the Ahargana, to each of which, 32" are due: therefore 10×32"=320", which product drawn into the difference 49, gives 320"×49= 4' 21" 20", and because the Moon's true, is greater than her mean motion, that Equation is additive.

# For the Moon's corrected place and distance.

| )'s uncorrected place (page 127) Add Desentara calas And last Equation | •       | -     | -        | • | 1        | 1' | 6′      | 547<br>26<br>4 | 67<br>0<br>21 |
|------------------------------------------------------------------------|---------|-------|----------|---|----------|----|---------|----------------|---------------|
| Subtract Andra vicalas                                                 | -       |       | •        | • | 1        | ı  | 7       | 21             | 27<br>49      |
| )'s Sputa Graha, or corrected place.                                   | :e<br>_ | •     | -        | • | - 1<br>1 | •  | 7<br>10 | 22<br>56       | 38<br>39      |
| o and D's distance, 12th Poongoni                                      | i, at O | ris ( | ing      | - |          |    | 3       | 34             | 1             |
| For the                                                                | relati  | ve n  | notion.  | ı |          |    |         | _              |               |
| "s Sputa Gati, Table XXVI,                                             | •       |       |          |   |          |    |         | <b>8</b> 40′   | O.            |
| ⊙'s do. do. Table XXVIII,                                              | ÷       |       | ě        |   |          |    | •       | 59             | 23            |
| Relative motion, 12th Poongoni                                         | •       |       | <i>:</i> |   |          | •  |         | 780            | 37            |
|                                                                        |         |       |          |   | OF       |    | 13°     | 0'             | 37            |

Moon's place corrected.

For the end of the Tidhi or time of conjunction.

Say: 13° 0' 37": 60":: 3° 34' 1": 16" 26" 59",

True time of conjunction.

the time after Sun rise on the 12th when the conjunction occurred.

With a view to establish the difference in the time of conjunction which would result from computing the same by means of an Ahargana (or sum of days) greater by one day than that which was obtained from the Elements of the Ariah Siddhanta, I have computed the Ahargana for the same conjunction as it would be by the Elements of the Surriah Siddhanta (Table XLIX, part 1), which is 1798148', being one day more than that which we have used in the preceding computation. Now if we divide this new quantity by the four Elements, the remainder in days, or Chundra Vakiam, will be 11, instead of 10 that it was before; which 11 days used as the Argument of Table XXVI, for the Moon's Equation, and true motion, and then following the process to the end, as has already been shewn, will give only a difference of 1' 42º in minus, in the ultimate result; (\*) the reason of this being, that if one day more be taken in the Ahargana, you compute necessarily the Sun and Moon's apparent places for the morning after the conjunction: in consequence of which, at the end of the operation, you have to deduct the time due to the Sun and Moon's distance from 60 guddias, supposed to mark the time of Sun rising.—Whereas if you compute with one day less, you will find the Sun and Moon's apparent places in the morning before the conjunction, and therefore the time due to their distance must be added, instead of subtracted, to that of Sun rising on the day computed for. It is therefore immaterial which of the two Ahar. ganas, by the Ariah or Surriah Siddhanta, are used in the Vakiam process.

## ARTICLE 4.

In the preceding Article I have shewn how the Sun and Moon's apparent places, their distance and time of conjunction are to be determined by certain Tamul Tables constructed for a particular spot in the Peninsula, which I conceive to be Trivalore. But as there should be a specific Desentara Table for every Meridian which is not that of Lanca, and as the object of this research is general, I shall dispense in future from using Table XLVII; and (excepting in the last example of all, where I propose resolving the time of the expunged month which will fall on the 5065th year of the Cali yug, reduced to the Meridian of Madras) all the rest of the computations will stop at Lanca. With a view to uniformity I shall therefore recompute the last operation from the point where it ceased to be common to all places, and by means of Table XXVII, determine the time of the last conjunction of the Luni-solar year 4923, as it would be reckoned at Lanca.

We have found at page 133, that the Moon's uncorrected place at Sun rising on the 12th Poongoni of the said year, at Lanca, was - 11' 6' 54' 40'

And the Sun's (page 133) - - - - 11 10 56 39

The same conjunction computed fur Lanca,

1

which on account of his presence, and the comparative slowness of his motion, the Tamuls never correct for the difference of Longitude nor his Arca Bhagábala. The last quantity is therefore, considered as his true or apparent place on the proposed day.

The San's Equation, diurnal motion, and Moon's ArcaBhagábala computed by means of Table XXVII, p. 2.

But there remains to apply the Moon's Arca Bhagábala to her uncorrected place, even for Lanca; and in order to be independent of Table XXVIII, which though sufficiently true for present time and for a great number of years past and to come, yet in process of time will be affected by the change in the position of the Sun's Apsis, we shall compute the Sun's diurnal motion as well as the Lunar Arca Bhagábala by means of Table XXVII, part 2.

with which referring to Table XXIV, we find his Anomalistic Equation 2° 9' 44", marked additive in Table XXVII, part 2, and for the reasons given at page 127.

The Lunar Arca Bhagábala is therefore . . +  $\frac{2^{\circ} \cdot 9^{\circ} \cdot 44^{\circ}}{2^{\circ}}$  +  $4^{\circ} \cdot 48^{\circ}$  (\*)

With regard to the Sun's diurnal motion, the same Argument of Anomaly referred to the same Table XXIV, will give the Equation of the Sun's true to his mean motion 13"; which as the day computed for falls before the 18th Poongoni, is still marked additive . . . 59' 8"

The Sun's true motion on the 12th current is therefore . . . .  $\frac{+}{\varepsilon 9}$   $\frac{13}{21}$ 

For the Moon's corrected place and her distance from the Sun at his rising on that day.

| ⊅'s un | corrected  | place     |   |   |  |      |      |   | 11* | 6* | 5 1' | 40" |
|--------|------------|-----------|---|---|--|------|------|---|-----|----|------|-----|
| Her A  | rca Bhagá  | bala      | • |   |  | •    |      |   | •   | +  | 4    | 18  |
| )'s ap | parent pla | ce sought |   |   |  |      |      |   | 11  | 6  | 59   | 28  |
| ⊙'s    | do.        | •         |   | • |  |      |      |   | 11  | 10 | 56   | 39  |
|        |            |           |   |   |  | Dist | tanc | e |     | 3  | 57   | 11  |

For relative motion.

| Gati     |       | •  | • | •  | •  | 14* | O' | O" |
|----------|-------|----|---|----|----|-----|----|----|
| de.      | •     | •  | • | •  | •  |     | 59 | 21 |
|          |       |    |   |    |    |     |    |    |
| notion s | ought |    |   | •  | •  | 13  | 0  | 39 |
|          | de.   | de |   | de | de | de  | de | de |

<sup>(\*)</sup> The Equation found at page 134, supposed to correspond to this, was + 4' 21".

True distance.

## For time due to distance.

Say 15° 0' 39" : 60" :: 3° 57' 11" : 18" 4" 33"

the end of the Amaria a Tillia aller Sua rise at Lanca.

The same was found for a different place in the proceeding article - 16 26 59

Difference 1 27 31

True time of conjunction.

The end of the 20th Tidhi of the Lunar month Phalguna of the year 4923, occurred therefore on the 12th of the Schr month Peopgeni of the same year; and the Prathama Tidhi or first of the Lunar month Chaliforn of the year 4924, on the 13th of the same month of the Solar year 4023.

Registering of the last Amayas ya Tidhi of A. C. 4923 and of the Prathama Tidhi of 4924.

Q. E. In.

The same conjunction computed by the Siddhanta process, was found to occur on the same day at 15°14° 23°; the difference of the result is therefore 1° 50° 5° and in European time 41° 2′, a difference easily accounted for by the dissimilarity of the processes, and of the Elements used in each mothed. Not is it to be believed that there may be found a greater degree of coincidence in the computations of different Tamul Astronomers, though using equally the Solar process; for independently of the Table known to them all, they contrive others for their own private use, both for general and local purposes, which do not always egice; and occasion quarrols are not him, which their ignorance of theory renders generally interminable.

ARTICLE 5.

Resolution of the two A energy Tilkis which determine the Oshaya or expunged month in a doubts in serving year.

Pesolution of the two An evisyas which delen ine a Cellaya month.

In order to since a notiber of useless trials of years and months on which the discarded Lunar month any fill, I right show in the 3d part of this Memoir, how the Hindus foretel that accident, by comparing the disc when the Moon's Apogee lies in one of the Signs of the Solar Zodiac which corresponds to any of the three shortest Solar months of the year, and also when a mean Adigate, or Lunar intercelary month is due, in a particular Solar month where it cannot be introduced. For it will be seen, that the first of these cases is to be expected when the Moon in Apogee is in the same sign, degree, &c. as the San in Perigne; and the second when the Moon in Perigne contains with the San in Apogee; and the probability of either occurring, is greater or less in proportion to the degree of coincidence of these Elements.

Indication when a Cshaya month will occur,

The same of an Adigali month.

111; and 100 years; and as the second is always the most probable one, considering that the last Cshaya occurred when the 4782d year of the Call yag had expired (A. D. 1681 and 1363 Sara), I shall conclude that the next must fall when 4923 years of the Call yag have elapsed; and lastly, as the month of Magail (Bagal Pauskie) in the present position of the Sun's Apsis, is the shortest month of the Solar year, I shall try the time of the two conjunctions, which may full

In the present reticle I shall be contented with the common trial of the three Cycles of 10:

Recolution of the 1st August syn which determines a Cshaya month.

near to its beginning and end.

I.

# For the first Amavasya.

#### A

The respective Aharganas for the beginning of Margali will be obtained as follows:

| 4923                   | Lunar.        | 4924                                         | Salar                   | •         |
|------------------------|---------------|----------------------------------------------|-------------------------|-----------|
| Aharganas 30th Phalgun | a 1798147 1st | Chaitram                                     | <b>1</b> 79816 <b>6</b> | 20 12 30  |
| Add 9 Lunations        |               | Ald number of days to the end of Cartiga (*) | 215                     | 18 37 10  |
|                        | 1798412[46    |                                              | 1798412                 | [38 49 40 |
|                        | 1             |                                              | 1                       |           |
| Aharganas sought       | 1798413       | 2d Margali                                   | 17:8413                 |           |

Here the two Aharganas are alike, but of the Soota dina after division by 7, the remainder for that of the Sun must be counted from Friday, and that for the Moon from Thursday: Hence the 2d Margali falls on Saturday, and the nearest Amavasya, on Friday, which by the Kalendar will be found to fall on our 18th of December (page 119).

B

For the Sun's Anomalistic Equation and Moon's Arca Bhagáltala, proceeding as in the preceding article, and with reference to Table XXVII, we shall find that the Sun's distance from his Perigee on the 2d Margali was 16° 18′ 12″, and by Table XXIV his Equation — 37′ 14″.

The Moon's Arca Bhagábala is therefore  $-\frac{37'14''}{27} = -1'22''$ .

U

| The Moon's Druva will be           | •        | •     | •     | 7' | 26° | 40' | 46* |
|------------------------------------|----------|-------|-------|----|-----|-----|-----|
| The Chandra Valliam 28; and its Eq | quatien, | Table | XXVI, | 0  | 8   | 26  | 0   |
| Lunar Arca Bhagábala (B)           | -        |       | •     | 8  | -   | 6   |     |
| D's Sputa Graha on the 1st Margali | -        |       | •     | 8  | 5   | 5   | 24  |

complete, or 2d commencing at Sun rise at Lanca.

And Moon's true motion, Table XXVI, 722' or 12° 2'.

υ

The Sun on the 1st Margali enters his 8th Sign (Kalendar, page 119) at 38z 47v 40p 60

Time to run to 2d Margali commencing - 21 10 20 which guddias and viguddias, because the month began at night time, are to be added to his Saura

<sup>(\*)</sup> Vide Table XLVIII, part 2d.

place, as calas and vicalas. Hence, after applying the usual Equation of Table XXVII, part 1, for 21s 10v 20p, which is 26' 27", the Sun's Sputa Graha at Sun rise at Lanca on the 2d Margali, will be 8' 0° 21' 36"; and by Table XXVIII, his true motion 61' 23".

E

| 2d Margali at Sun. § ©'s Sputa Graha (D) rise at Lanca. § D's do. do. (C) |            | • | - |   |   | 21'<br>5 |    |
|---------------------------------------------------------------------------|------------|---|---|---|---|----------|----|
| Soob-vi-Arca Indoo Graha                                                  | <b>-</b> · | - | - | ō | 4 | 43       | 48 |

F

#### For relative motion.

| O's Sputa Gati (D)      | • - | • | - | - | 1* | 1′ | 23         |
|-------------------------|-----|---|---|---|----|----|------------|
| )'s do. do. (C)         | •   | • | • | • | 12 | 2  | 0          |
| Soob-vi-Arca Indoo Gati | '   | • | ė | • | 11 | 0  | 3 <b>7</b> |

G

### For time due to distance.

The rule will be as before  $\frac{60 \times 4^{\circ} 43' 45''}{11^{\circ} 0' 37''}$  and the time due to distance 25° 46° 27°, and because the Moon was more advanced than the Sun in the Zodiac, the above result shews the time elapsed at Sun rise on the 2d Margali since the conjunction had occurred; therefore, from -  $60^{\circ}$ 

|                       |   |   |            | Subtract | 25 46' 27" |  |
|-----------------------|---|---|------------|----------|------------|--|
| True time of Amavasya | • | • | <b>~</b> ⁺ | -        | 34 13 33   |  |

after Sun rising on the 1st of Margali.

H

| But it appears   | by the Solar | Kalendar, | page | 119, t | hat the Sun | enterco | l the | sign        | Dhanus | ŧ | on |
|------------------|--------------|-----------|------|--------|-------------|---------|-------|-------------|--------|---|----|
| the same day, at | •            | •         | -    | -      | -           | •       | 383   | 49 <b>°</b> | 40°    |   |    |
|                  |              |           |      |        |             |         | 34    | 13          | 33     |   |    |
|                  |              |           |      |        |             |         |       |             |        |   |    |

End of the 30th or Amavasya Tidhi 2 4 36 7

before the Sydereal commencement of the Solar month Margali, when the Sun was therefore still in the sign Vrischica m; that is, in the Sydereal month Cartiza, although the Civil Margali had begun.

I

Since the Amarasya Tidhi of the Lunar month Cartiga fell on the 1st Margali Sydereal account, at night time, it is to be coupled with that Solar date; and the Prathama Tidhi of the

ensuing Lunar month Margari as (if any such month were to be counted in the year 4004 of the Cail yag) should can sport to the 2d Margali. But by the Kalcadar, page 119, the Sydereal Folia month Cartiga council 00 and the Chil 00 days, therefore the Amaraya under concideration, instead of the 1st Margali, must stated apposite to the 00 h. Chill day of Cartiga; and the Prath and Tiblical the ensuing Lunar month, it the 1st Civil That all, which was accordingly done in the Panchangum for that year (vide page 68). We shall see, however, presently, that the next Lunar month was not to be called Margash as, but Panchan.

ιĬ.

For the second Amarasia or next conjunction, which must full about the end of the Solar month Margali 1 or beginning of Typ vs.

Resolution of the 21 Amayasya which determines a Cshaya month. Not to repeat unnecessary, what most now be familiar to the reader, I shall state that if one Lunation be added to the law Lunar Ahargana, and the absolute duration of the month Margali, as given in Table III, to the last Sclarone, the respective Aharganas, now required, will be, viz. the Lunar 1798412, and the Colar - 17824412 [198-427-412]

and therefore that to be used for the Floor's Druca and Chandra + 1

Vakiam - 2d Tye 4024, is - 17584 12

The Solar Sooke dina will distribute be Sundapara, Saturday, the 11th January 1928; and the Lunar, Sucra-vara, Friday, 10th.

B

For the Sun's Anomalistic Equation and Lunar Area Ehagábala, it must be observed on referring to Table XXVII, part 2, that passing from Margali to Tye, the Sun Las entered the third quadrant of his Anomaly; and consequently, that the Argument of his Equation, though still referred to his Perigee, in now increasing, from decreasing flat it was before. In computing the Manda Kendia, we are therefore to take from Table XXVII, part 2, let Tye 12° 42' 40'

O's mean motion in one day

Manda Kendra, 2d Tye

This is a substitute of the State 
 $\mathbf{C}$ 

For the Moon's apparent place at Sun rise on the 1st Tye complete, or 2d at Sun rise, the Chandra Vakiam will be 57.

Her Druva
And the Equation of Valsiam 57

From which subtract Area Bhagálala

D's Sputa Graha, 1st Tue complete

and by the same Table XXVI, her true motion or Sputa Gati 720cdb, cr 12' 6'.

D

For the Sun's apparent place on the 21 Tye at his rising, we see by the Kalendar, page 119, that he completed his 9th Sign and entered Macara vs, at

59° 42° 41°
60
0 17 19

which shows night time; therefore the vicalas and paras are to be added to his Saura place, and are 17,3.

At the expiration of the 1st of Tye or at Sun rising on the 2d, the Sun has therefore only gained 17' in his 10th Sign, and the ©'s Sputa Graha is 9'0'0' 17" (\*), and by Table XXVIII the Sun's true motion on the 2d Tye is 61'23" or 1'1'23".

E

## For the Sun and Moon's distance.

| 2d Tye at Sun rising § ①'s Sputa G<br>at Lanca or b's do. | raha<br>do. | (D)<br>(C) |        | <u>.</u> | -    |   | 9 <b>'</b><br>8 | 0°<br>25 | 6′<br>37 | 177<br>39 |
|-----------------------------------------------------------|-------------|------------|--------|----------|------|---|-----------------|----------|----------|-----------|
| Soob-vi-Arca Indoo Grah                                   |             | •          |        | -        | -    |   |                 | 4        | 22       | 33        |
|                                                           |             |            | F      |          |      |   |                 |          |          |           |
|                                                           | For         | the re     | lative | mot      | ion. |   |                 |          |          |           |
| ⊙'s Sputa Gati (D)                                        | -           | -          |        | -        | -    |   | -               | 1*       | 1'       | 23*       |
| )'s do. do. (C)                                           | -           | -          |        | -        | -    |   | -               | 12       | 6        | 0         |
| Soob-vi-Arca Indoo Gati                                   |             | •          | •      |          | •    | • |                 | 11       | 4        | 37        |

G

And for the time due to distance.

$$\frac{60 \times 4^{\circ} 22' 38''}{11^{\circ} 4' 37''} = 23g 42v 35p.$$

and as the Moon was less advanced than the Sun, the above quantity marks the time after Sun rise when the conjunction was to occur.

Ħ

By the Kalendar, page 119, the Sun entered the Sign Macara v9 on the 1st day of the Solar month Tye, at - - 59g 42v 41p 60

that is, before Sun rise on the 2d - - 17 19

Now the Amavasya occurred (G) - - 23 42 35

after Sun rise. 23 59 54

<sup>(\*)</sup> Here, as the fraction is only 17", the Equation by Table XXVII, part 1, is insensible.

adding therefore these two quantities, we find that the conjunction occurred 23° 59° 54°, after the Sydereal beginning of the Sular month Tye.

I

By the first part of this article, the conjunction near the beginning of Margali 1 fell 4 36 25° define the San entered the Sign Dharus 1 (page 139), and by the second part, the Amarasym which was to occur about the beginning of Tye vs took place 23° 59° 54° after he had left it (page 141). Hence there was no conjunction during the time that the Sun was in the Sign Dharus 1; in consequence of which the name of one of the Lunar months, (which in the present case is Margasirus) is to be passed over; and that which follows the Solar month Cartiga, (viz. Paushia), is to be used. In the Panchangum, however, it is customary to write the names of both; annexing the word Cshaya thereto. Thus we find in the Kalendar of A. C. 4924, page 52, for the mentic under consideration, Cshaya Margasirus Paushia.

How in that year the Lunar month Cartica happened to correspond with the Solar Cartiga, and occasioned Paushia to answer to Margali, will be explained in the next article.

I shall close these observations by a remark of Audy Sashaya, which I give in his own words.

- " As it is customary in the first instance to compute the general Adigoh, and Cshaya months,
- " such as these would occur at Lanca, which is supposed to have neither Latitude, nor Longi-
- 46 tude, the results of such computations must be considered as indispensable approximations,
- " without which, the problems could not be resolved.
- "But when afterwards computing the Kalendar for any particular place, where there is of
- 66 course Latitude and Longitude, there may sometimes be both an Adigah and a Cshaya at
- 6. Lanca, and mone at the proposed place.
  - "When there is a great difference of time between the commencement of the Solar month, and
- the preceding conjunction, then the Adigahs and Cohayas will be the same all over India; but
- " in the contrary supposition, when that interval is but small, the case may be otherwise."

### ARTICLE 6.

Resolution of the two Americayas which determine the first intercalation due to the year 1324 of the Califying.

If the order of the times were followed, this article should have preceded that which treats of the expunged month of the same year, for in the case of a double intercalation the first Adigah month always precedes the Cshaya.

But it will be shewn in the third part of this Memoir, that the first indication of a Cshaya is that a mean Adigah month will fall in any particular year, on a month where it cannot possibly be inserted, because the Solar month happens to be shorter than the Lunar one. The Cshaya is therefore the accident which draws with it the double intercalation, and prepares us for the same, and on that account it was entitled to the precedence.

Resolution of the two Amayasyas which determine an Adigah month.

As it generally occurs that when the Cshaya falls on Margusiras, the first Adigah due in the same year occurs in the Schar months which answer to the Lunar Aswina and Phalguna, and which are Paratasi and Poingoni, I shall now proceed to the resolution of the two changes which affect the former.

Resolution of the first Amavasya which determines an Adiguh month.

## For the Aharganas.

|                     | 4923     | Lunar.  | 4924                                         |                        | Solar.                     |       |     |
|---------------------|----------|---------|----------------------------------------------|------------------------|----------------------------|-------|-----|
| Ahargana 50th Lunai | Phalguna | 1798147 | 1st Chaitram                                 |                        | 17931664 20                | ' 12° | 30° |
| Add 6 Lunations     |          | 177     | Time to run to the las<br>Auvani, Table XLVI | t day cf:<br>II, p. 2. | 156 26                     | 41    | 6   |
|                     |          | 1798324 | Ahargena 1st Paratas                         | i _                    | 1798522 [46                | 56    | 36  |
|                     |          | Aharga  | na 3d Paratasi at Sun 1                      |                        | 7)1798324(256<br>mainder 3 | 903   |     |

which remainder 3 being counted from Filday, gives the Social dina, Someward (Monday); and as we have added 2 days to the Ahargana of the 1st Paratasi, the computation will be for the 3d Paratasi, at Sun riving.

Resolution of the lat Amayasya in Paratosi.

Having found that the Sun entered the Sign Canya my on the 1st Paratasi at 46° 56° 36° after Sun rise (Halendar, p. 119), and that the Ahargana to be used was 1793324°, I shall briefly state, that the Chandra Vakiam is 137; the Moon's Arca Bhagabala — 4' 40'; her Druva 6' 28' 56' 40", its Equation 16' 8' 52' 0", and the Sun's Equation — 1 40 (Table XXVII). The respective Longitudes at Sun rise on the 2d Paratasi, will therefore be,

The relative motion by Tables XXVI and XXVIII.

The time due to distance is therefore  $\frac{60 \times 6^{\circ} \cdot 32^{\circ} \cdot 37^{\circ}}{12 \cdot 4 \cdot 34}$  . 32° 30° 43°

and as the Moon was more advanced than the Sun, it shows that the conjunction had passed, and that the time above found is to be retrenched from that of Sun rising on the 3d Paratasi, when the 2d is completed.

|                                                                       | G. | ₹. | P. |  |
|-----------------------------------------------------------------------|----|----|----|--|
| Now the Sun entered the Sign Canya m on the 1st Paratasi, at          | 46 | 56 | 36 |  |
|                                                                       | 60 | 0  | 0  |  |
| After Sanrise; there remained therefore from that instant to the 2d   | 13 | 3  | 24 |  |
| And the time of conjunction being on the 21 after Sun rise, at        | 27 | 29 | 18 |  |
| The Amarasya took place                                               | 40 | 32 | 42 |  |
| r the Sun's entrance into the new Sign, when 40° 32° 42° had elapsed. |    |    |    |  |

after

# Second Amavasya.

Resolution of the 2d Larasva n hich Geteimings an Adigah month in Paratagi.

When two successive conjunctions are to be determined, the Hindu computers contrive to abridge the process by omitting to consider the Aharganz, and working for the Sun's place, by adding the absolute duration of the following Solar month to the fractional part, in guddias, viguddias, &c. of the time of beginning of the month elapsed. This gives the Sydereal end of the month to be worked for: but as the Sun and Moon's apparent places are wanted for the time of Sun rising, the excess of time over a complete day (which in Solar computations is always the instant referred to) is to be retrenched from the entire Sign, if the preceding morning be wanted: but its complement to one degree is to be added if the end of the same day be required.

In the same manner they avoid computing again the D's Druva, by considering first what the Chandra Vakiam Dhurmavanham was at the last conjunction; then adding thereto the number of complete days resulting from the addition of the duration of the absolute menth to the fractional part spoken of at the beginning of this article, and subtracting the number of days that may have been added to the beginning of the month for reaching the Lunar Soota dina, the remainder gives the Chandra Vakiam, or Argument sought. And secondly, considering that the Moon's Druva varies only once in a Devaram or 248 days, they conclude that having only added 29, 30, or 31 days to the original Ahargana, it may not have increased during that interval, on which they proceed, being certain that the result will prove whether the assumption has been a right or a wrong one.

A particular method for shortening the process.

> As the process here adverted to has not yet been presented to the reader, I shall compute the second Amavasya more in detail than I otherwise should have done.

#### A

|                                                                        | D. G. V. P. |
|------------------------------------------------------------------------|-------------|
| The fractional part of the last Solar Ahargana (page 142) was          | 46 56 36    |
| The absolute number of days in the Solar month Paratasi, Table III, is | 30 27 22 1  |
| Epoch of Sun's entrance into the Sign Tula -                           | 31 14 18 37 |

which therefore began at day time, so that the guddias and viguddias are to be subtracted as calas and vicalas from the Sun's Saura place; but as on the 1st Arpesi the Equation given in Table XXVII, part 1st, is only 1' in 8 days, it is insensible in the present case, being only 1", and may be neglected. The Sun's Longitude at Sun rise of the 1st Arpesi, will

and by Table XXVIII his true motion is 59' 44" on the 1st Arpesi.

В

The Sun's Anomalistic Equation by Table XXVII, part 2d, will be found — 2° 7' 25"; and the Lunar Arca Bhagábala —  $\frac{2^{\circ} - 7' - 25''}{27} - \frac{4' - 45''}{27}$ 

C

For the Moon's Druva, Chandra Vakiam; and apparent place.

The Chandra Vakiam found for the last conjunction (page 143) was - 1874

To which add the number of entire days found at article A - 31

But 2 days had been added to the Solar Ahargana for equating it to the Lunar one, which subtract - 2

Chandra Vakiam for the present operation - 216

Now as we have only added 31 days to the Ahargana for Paratasi, the Vakiam of which was 187 days, we may suppose that the Moon's Druva has not changed; we take it therefore as at page 143.

| D's Druva -         | -           | •  | - | - | • | 6. | 28° | 5 <b>6'</b> | 40 |
|---------------------|-------------|----|---|---|---|----|-----|-------------|----|
| Add Equation due t  | o Vakiam 2  | 16 | - | - |   | 11 | 0   | 21          | 0  |
|                     |             |    |   |   |   | 5  | 29  | 17          | 40 |
| Subtract Moon's Arc | a Bhagábala | 1  | - | • |   |    |     | 4           | 43 |
| D's Sputa Graha, 1s | t Arpesi    | -  | • |   |   | 5  | 29  | 12          | 57 |
|                     |             |    |   |   |   |    |     |             |    |

and her true motion, Table XXVI, 761calas, or 12° 41'.

D

For the Sun and Moon's distance.

| 2d Arpesi at Sun; O's Sputa Graha (A) rise at Lanca D's do. do. (C) | -      | - | * | 5 <b>'</b><br>5 |   |    | -~- |
|---------------------------------------------------------------------|--------|---|---|-----------------|---|----|-----|
| Di                                                                  | stance | - | • | 0               | 0 | 32 | 45  |

( 146 )

E

Relative motion.

F

For time due to distance.

$$\frac{60\times0^{\circ} 32^{\circ} 45''}{11^{\circ} 41^{\circ} 46^{\circ}} = 2^{\circ} 48^{\circ} 6^{\circ}, 8$$
 after Sun rise.

G

We have found at article A, that the Sun entered the Sign Tula 
on the 1st Arpesi after Sun rise, at

14<sup>g</sup> 18<sup>y</sup> 37<sup>p</sup>

And by the lest article F, that the conjunction took place also on the 1st

And by the last article F, that the conjunction took place also on the 1st, after Sun rise, at - - - 2 48 7

There wanted therefore - - - 11 30 30

11° 30° 30° of time when the Amavasya occurred, for the Sun to enter the Sign Tula ≏; he being then still in Canya m.

Conclusion.

Conclusion.

The first Amavasya took place on the 2d Paratasi (page 144) 40° 32° 42° after the Sun had entered the Sign Canya m; and the second, or that of the ensuing Lunar month, when there wanted 11° 30° 30° of his entrance into the Sign Tula c, from which it follows that two conjunctions occurred during the time that the Sun was in Canya m, and therefore, the name of the Lunar month Assina, which concurs with the Solar Paratasi, must be repeated, calling it Adigah the first time, and Nija the second.

It would be a misapplication of time and labour to give the further resolution of the second intercalation, which in the 4924th year of the Cali yug, (or the 1745th from the birth of Salivahana) occurred during the Solar month Poongoni, and fell on the Lunar Phalguna, called Phalguna Mitiek, or Adigah Chaitra; so that in the said Luni-solar year there were two Chaitras, and no Margusiras. The process for both intercalations is in every respect the same, and (as far as I am able to judge) requires no further illustration.

I shall, therefore, close here my researches into the Astronomical part of the Luni-solar Panchangum, which by some classes of readers will, I have no doubt, be deemed unnecessarily extended. I declare, however, that I long, but vainly endeavoured to reduce these two parts of the second Memoir to a narrower compass. Whatever I attempted to retrench, left a chasm which I was compelled to fill again, because it interrupted the course of argument, prevented the exposition of certain ingenious methods intended to shorten the process, and in some cases deprived the reader of the opportunity of useful references.

### Note.

I have already stated that it is an invariable practice throughout India, to call each Solar and Luni-solar year by the name of that of the Cycle of 60 years to which it corresponds; a custom which may prove of great resource in Chronological researches. As there will be found in this collection a separate Tract which treats especially of the three different modes according to which the years of the Vrihaspati Chacra are computed in different parts of India, I shall only advert here to two very short practical Rules which elicit the name due to any proposed year, either according to the precepts of the Surriah Siddhanta, or to the Tellinga account, both of which are given in the General Tables at the end of the Volume.

Note on the specific name given to each Hindu year, whether Solar or Luni-solar.

l.

# According to the Surriah Siddhanta.

"Divide the numeral of the proposed year by 86; add the quotient to the dividend; divide the sum by 60, and the quotient will give the number of cycles expired since the beginning of the Cali yug; and to the remainder, if the proposed year be less than 31 from the last expunged year of the Chacra (to be found in Table XVIII), add 28; but if the said year falls in the 55 remaining years of a cycle of 86 years, add 27; and the remainder so increased will indicate the numeral of the year current of the Chacra, and consequently its appropriate name."

Precept for the name of the Chacra year according to the Surriah Siddhanta and Tika,

(For an Example, see page 214).

11.

The same according to the Tellinga account.

Course the years expired of the Cali yug by 60; the quotient will give the number of cycles expired, and the number of units in the remainder counted from *Pramathi*, the 18th of the Chacra, as one, will give the name of the last Vrihaspati year expired, and the following one that of the year sought.

Precept for the name of the Chacra year according to the Tellinga account,

### EXAMPLE.

Let the name of the same year of the Cali yug 4924, be wanted according to the Tellinga Example. account.

60) 4923 (82 120 remainder 3

which counted from Pramathi as one, gives Brisya for the name of the last expired, and Chitra-bhanù, the 16th of the Chacra, for that of the current one.

Although I have taken notice of some of the Astrological articles and ephemerides in the description which I have given of the Siddhanta Chandra Panchangum at the beginning of this Memoir, yet I shall not attempt to analyze any of them before dismissing it. But if the reader

be curious in these matters, he may collect valuable information on the Yoga, Carna and Isharum, on referring to the commentary which follows the present tract.

N. B.—I was told by the Madras Sastras that the Luni-solar year, which is chiefly used in Bengal, is the Bhanu Husputtia Chandra Mana, the months of which, considered as secondary, are called Gauna, in contradistinction to Múkya, the name given to those of the Siddhanta Chandra Mana, which are primary, the former beginning with the full Moon instead of the new Moon which precedes the commencement of the Solar year. As I have sometimes found the Carnatic Pundits and Sastras misinformed on matters of Bengal usages, and customs, and particularly on those which depend on Hindu Astronomy, they may also be mistaken in this statement; but it is a point which may be easily settled in Calcutta. Be this as it may, however, as I find it stated in several books that the Bhanu Husputtia, differs in no respect, but in the time of its beginning, from the Siddhanta Mana (as it is called on this Coast), the same principles and rules which were disclosed in this Memoir, will serve equally for the construction of the above mentioned Luni-solar year.



# PART III.

On the Hindu method of determining the mean Epochs of Intercalation.

ALTHOUGH Hindu Astronomers seem never to have been much in the habit of foretelling celestial Phonomena for remote times, yet (as we have already seen) they are in no respect deficient in means for calculating with a certain degree of accuracy, the occurrences which depend on time for any Epoch whatever.

The manner of intercalating the Lunar months being an article of the first importance in the construction of the Panchangum, the rare and unequal recurrence of double intercalations with a consequent expunged month, made them consider how these circumstances might be anticipated with a tolerable degree of certainty and without that expenditure of time and labour, which loose trials by the Siddhanta rule, must necessarily occasion. This attempt naturally suggested the resolution of the mean Epochs when from the combined revolutions of the Sun and Moon these Equations were due. They seem first to have attended to the relative motion of the two Luminaries, and then proceeding more scientifically to those of their Apogee, they concluded that when the Moon in Apogee coincided with the Sun in Perigee, it necessarily occasioned a simultaneous short Solar, and long Lunar month; lastly, they discovered that when the Moon's Apogee was in about fifteen degrees of either of the Signs Vrischica m, Dhanus \$\pi\$ or Macara 197, (which for many ages past are in possession of the Sun's Perigee), if a mean intercalation was due about the middle of the corresponding Solar month, it was impossible that the Epoch elicited by their rules for intercalating should be the true one consistently with their own theories.

For since each of the three Solar months Cartiga, Margali and Tye are now shorter than a mean Lunation; and since the Moon when near her Apogee has a slower apparent than mean motion, it is manifest that under such circumstances neither of the three aforesaid short Solar months could contain two changes of the Moon.

The same consideration must have also led them to discover that when there was no change in either of the said short Solar months, then there were two new Moons in two other months of the same year (or to be more precise, a double change in one of the six preceding, and another in one of the six following months), occasioning thereby two intercalations where only one could be admitted. They appear then to have taken a hint from nature, and agreed to suppress the month on which no conjunction occurred: thus preserving, with apparent metaphysical consis-

tency, both the general theorem, and that Equation of one Lunar month only which was sufficient for keeping the commencement of the Luni-solar year, within its accustomed distance, from that of the Solar one.

If we consider well the nature of their Chronological doctrines, we must admit that, under the force of circumstances, they could not adopt a less arbitrary measure; for it depends more upon nature (though much less to the purpose) than our bissextile intercalations, and is less exceptionable than the irregular, and indefensible duration of our months.

Such, after an attentive consideration of the doctrine of Lunar intercalations, appears to me the origin of the theory and practice of a method which has no doubt led to the discovery of the three Cycles of 19, 141, and 160 years, in either of which a double intercalation must recur.

### ARTICLE 1.

The resolution of mean intercalations by the Hindu rule.

Mean intercalations.

Let it be proposed to determine whether an intercalation be due to the 4924th year of the Call you current.

Rule.

19 Reduce the proposed years into mean or Saura months.

4923×12=59076 Saura months.

Then say, as the number of Saura months in a Maha yug - 518 40000
To the number of Adigah months in the same - 1593336
So the number of Saura months above found - 59076

To the number of Adigah months sought  $\frac{1593°36 \times 50076}{51840000}$  - 1815

with a remainder of 38317506.

Now from the divisor - - 518 10000
Subtract the remainder - - 38317506
Second remainder - - 13522494

which second remainder divide by the number of Adigah months in a Maha yug,

1590336)13522494(8 months

Remainder 775806

Multiply by × 30

)23274180(14 days

Remainder 967476

Multiply by × 60

)58048560(36 guddias

Remainder 788464

Multiply by × 60

)473078 10(29 viguddias

Remainder 1100096

Multiply by × 60

)66005760(41 paras

Remainder which need be carried no further 673984

This result shows therefore, that a mean intercalation is due when 4923y 8m 11d 36g 29v 47p of the Cali yug have elapsed, referred to mean midnight at Lanca; and therefore, that the intercalation will fall in the 4924th year of the said æra; about the 15th Margali at 365 29 after mean midnight.

Observing that the Hindus compute that the first intercalation that was due after the beginning of the Cali yug, fell when 2y 8m 16d 3g 55" &c. had expired, I analyzed that proposition as follows:

The primary period of 25 Sm 16d 3g 55v &c. may be reduced to this expression in months and parts, 32m,5355104008 &c.: Hence by the Hindu formula we have \frac{1593236 \times 32,5355104008}{51840000}

The primary Epoch of intercalation accounted for,

The numerator being equal to 51839999,99 &c. or 51840000, which shows that at the above primary period (2y 8m 16d 3g 55v 7P,39 &c.) there was precisely an intercalation due; and from this cause at every succeeding period a mean intercalation recurs.

# Account of Table XXIX.

After what has been said, the Table of Intercalations is easily explained; the only thing to Account of Intercalary Table. be remarked is, that the additional 7,39 paras are neglected in its construction.

This Table, however, is subject to an additive Equation or Cshepa of 35 50 which remains uncxplained.

## EXAMPLE I.

Let it be proposed to determine whether the year Cali yugam 4024 current be subject to an Application. intercalation.

| By Table X                        | XIX, p  | art 3, for  | 1898 years   | -        |                | -                | -            | 7.<br>1897   | и.<br>10 | p.<br>25           | с.<br>41 | v.<br>40   |
|-----------------------------------|---------|-------------|--------------|----------|----------------|------------------|--------------|--------------|----------|--------------------|----------|------------|
|                                   |         |             |              |          |                | Multi            | ply by       | 7            |          |                    | ×        | 2          |
|                                   |         |             |              |          | 1              | Part 3           | (1)          | 3795<br>948  |          | 21<br>12           | 23<br>50 | 20<br>50   |
| Indices.<br>4923<br>Sub. (1) 3795 |         | ,           | Assumed Dru  | va for s | ucceedin.<br>1 | gyears<br>Part 2 | s (2)        | 4741<br>170  |          | 4<br>22            |          | 10<br>45   |
| 1178 <sup>'1</sup>                | Take th | e nearest i | n the Table. |          | Pa             | ert 1 -          | (3)<br>· (4) | 4915<br>8    |          | 26<br>13           | 20<br>11 | 55<br>45   |
| Sub. (2) 47 14<br>179             | do.     | do.         | do.          |          | C.             | shepa            |              | 4923         | 8        | 14<br><del> </del> |          | 40<br>50   |
| 4923<br>Sub. (3) 4915             |         | •           | •            |          |                |                  |              | 4923<br>4923 | 8        | 14<br>14           | 36<br>36 | 30<br>29,6 |
| (4) 8                             | do.     | do.         | do.          |          | Differ         | ence in          | sensi        | ble          | ~        |                    |          | 0,4        |

### EXAMPLE II.

For the year 4732.

For the year 4782 by the Tables,

Here, in order to save trouble we may start from the nearest year already expounded.

Which being 4741 (Example I) we take any Epoch already

Y M. D. G. Y

expounded, which call Druva

Part II,

4744 9 4 14 10 (Example I). 37 11 14 54 50

Cshepa, or Equation

4782 8 19 9 0 + 3 50

4782 8 19 12 50

which quantity is the same as that produced by the Hindu rule.

EXAMPLE III.

For the year 5064.

For the year 5064 by the Tables.

We may commence with the Epoch of 4923, elicited in Example I.

| Druva<br>Part II, |   |    |           | 8 | 14       | 36 | v.<br>30 (Example I).<br>55 |
|-------------------|---|----|-----------|---|----------|----|-----------------------------|
| Part I,           | - | 8- | 5055<br>8 | - | 21<br>13 |    | = -                         |
|                   |   |    | 5064      | 8 | 10       | 0  | 10                          |

Here we need not add the Equation, because it is already involved in the quantity which marks the Epoch of intercalation for the year 4923 (vide Example I).

In the three preceding cases we are to notice the same circumstance, namely, that each indicates the intercalation to be due on the 9th month (or 8th complete) of the respective years, which falling on the Solar month Margali (one of the 3 short ones and when the Sun is in the Sign Dhanus f), indicates that the order of true intercalations is interrupted (page 149); and as in the three cases, the days on which the mean one is due, are not remote from the middle of the month, if the Moon's Apogee should lie about that time somewhere near 15° of the Signs Vrischica or Dhanus (m and f), the Hindus conclude that there must be two intercalations with an expunged month, in the years Cali yugam 4782, 4923 and 5034.

Years when a month may be expanded.

We shall shew presently how that Element may be expounded without having recourse to the endless Rule of the Surriah Siddhanta.

Years which are not intercalary how tound,

The preceding Rule and Tables, may serve equally to determine what year is a common one; for if by adding any number of the periods given in the Table we do not elicit the proposed one, then it is certain that it is neither an Adigah nor a Cahaya year.

## EXAMPLE IV.

Let it be required to know whether the year Cali yugam 4781 be an Adigan year?

Then proceeding as before.

and as in the present case we could not take a lesser period out of Table IX than 2y 8m 16d % 55v (the next above zero), it is clear that the proposed year 4781 is a common Sumpat-saram, or year of 12 Lunar months.

## ARTICLE 2.

I shall now proceed to show how the place of the Moon's Apogee for any Epoch not ascending beyond the year Cali yugam 4399 complete (A. D. 1297) may be ascertained by means of Table XXI, as accurately as if it had been computed by the Siddhanta process.

To find the mean place of the Moon's Apogee by the Tables.

This method, which is supposed to have been devised by Vavilala Cuchinna, an Astronomer said to have lived at the above Epoch, presupposes the knowledge of a Rule contrived for eliciting a sum of days in lieu of the Ahargana, which serves as an Index to all the Tables of the author referred to.

Rule of Vavilala Guckinna for fanding-the Ahargana from the year 4399 complete of the Califyug, as an Epoch called the Index in his process.

This Rule differs little from the common one in point of form, for like all these that we have hitherto seen, it is performed with the universal instrument the Trivasica; only that in coder that the results may always be the same as if they had been computed from the origin of the Cali yugam, we are to add 85211 before division by 180,000, and subtract 3875864 before division by 13358334.

Precept.

#### RULE.

To find the sum of days which will serve as an Index to the Table, for the year Cali yugam 4923.

Rule.

| As 499    | 23 years of the Cali yi | ug ende        | ed on the 12          | th of the           | Solar mon      | th Poongo | ni at midnigh | t at |
|-----------|-------------------------|----------------|-----------------------|---------------------|----------------|-----------|---------------|------|
| Lanca, s  | ay •                    | -              | Epoch                 | •                   | •              | •         | 4923<br>4399  |      |
|           | Number of years elap    | $\mathbf{sed}$ | •                     | •                   | -              | • '       | 534           |      |
| For the l | Index and initial feria | 6638           | 89×524+852<br>180,000 | <del>11</del> = 19. | 3 Adigah       | months.   |               |      |
|           |                         |                |                       | 52<br>13            | -              | 7         |               |      |
|           |                         |                |                       | 628.<br>+ 19        | · <del>-</del> |           |               |      |
| Number    | of Lunar months elap    | sed'           | ē                     | 618                 | 1              |           |               |      |

Index.

For the mean place

of the Moon's Apogee by the Tables on

the beginning of the

year,

Sum of days or Index

7)191389(27341

Remainder 5

which, as in the case of the Tellinga rule, is to be counted from Thursday, and therefore we have, as before, Sani-vara (Saturday) the initial feria of the Luni-solar year 4023.

The Druva or mean place of the Moon's Apogee, for the last day of the 4399th year of the

Cali yug was
The Bijah, or correction due to the same
The motion of the D's Apogee in 1 day

4º 15° 26' 17'
1 29 1 (†)
40 59"

With these data proceed as follows; the Index being 191389 days.

100000

For the Moon's Mandocha.

| 100000                                                                     | -             | -     | -           | -        | 11'      | - 8"   | 17'             | 27"      | 4 1*     |
|----------------------------------------------------------------------------|---------------|-------|-------------|----------|----------|--------|-----------------|----------|----------|
| 90000                                                                      | _             | -     |             | -        | 10       | 4      | 27              | 42       | 57       |
| 1000                                                                       | -             | -     | •           | -        | 3        | 21     | 22              | 58       | 29       |
| 300                                                                        | _             | .=    | _           | -        | 1        | 3      | 24              | 53       | 33       |
| 80                                                                         | -             | _     | -           | -        | <i>_</i> | 8      | 54              | 38       | 17       |
| 9                                                                          | •             | -     | -           | -        |          | 1      | o               | S        | 48       |
| 191389                                                                     | ,,,           | _     | _           | -        | 2        | 17     | 27              | 49       | 48       |
| Druva                                                                      | -             | -     | -           | -        | 4        | 15     | 26              | 17       | 0        |
| And as the Rule and Bruva are adapt<br>Add semi-diurnal motion of the Apog | ed for<br>gee | the p | recedi<br>- | ng noon  | - 7      | 2+     | 5 <b>4</b><br>3 | 6<br>20  | 48<br>29 |
| The same by the Siddhanta process,                                         | (p. 8         | 4)    | _           | _        | 7        | 2<br>2 | 57<br>57        | 27<br>26 | 17<br>12 |
|                                                                            |               |       |             |          | Di       | Tere   | nce             | 1"       | 54       |
| Correction of Bija                                                         | ah for        | 4 Re  | voluti      | ons in a | Mah      | ıa yı  | g.              |          |          |
| 100000                                                                     |               |       |             |          |          |        |                 |          |          |

| 100000                    | -       | -       | -   | -     | _     |     | 4′        | 55* | 52* |
|---------------------------|---------|---------|-----|-------|-------|-----|-----------|-----|-----|
| 90000                     |         | -       | -   | -     | _     |     | 4         | 26  | 17  |
| ,1000                     | -       | ~       | •   | -     | -     |     |           | 2   | 58  |
| 300                       | -       | ~       | -   | -     | -     |     |           |     | 53  |
| ·80                       | -       | -       | -   | -     | -     |     |           |     | 11  |
| 9                         | •       | -       | ,   | •     | -     |     |           |     | 2   |
| 191389                    | •       |         |     |       |       |     | 9         | 26  | 16  |
| Equation due to Druva     | ~       |         | •   | -     | -     | 1°  | 29        | 0   | 54  |
|                           |         |         |     |       |       | 1   | 38        | 27  | 10  |
| Mean place of the Moon's  | Apogee  | -       |     | •     | 7'    | 2   | <b>57</b> | 27  | 17  |
| TPL .                     |         | Corre   | ted | place | 7     | 4   | 3.5       | 54  | 27  |
| The same by the Siddhanta | process | (p. 86) |     |       | 7     | 4   | 35        | 53  | 22  |
| For the Prathama Tidhi of |         |         |     | Di    | ffere | nce |           | 1"  | 5*  |

<sup>(\*)</sup> This process is the same as that which is used for finding the Index to the Table of the Planets for computing their mean places.

(†) Table XXI.

But we want the place of the Moon's Apogee for 8m 14d 365 30v later + the remainder in the month of Poongoni 4923 from the time of the Lunisolar date of the beginning of the Chandra year.



| Now by Table III the absolute month of Poongoni contains  From which subtract | • | 30 <sup>4</sup><br>12 | 2)' | 21" | 2* |
|-------------------------------------------------------------------------------|---|-----------------------|-----|-----|----|
| For 8 Solar months complete                                                   |   |                       |     | 30  | 11 |
| Number of days clapsed -                                                      |   | 308                   | 36  | 21  | 13 |

And for the motion of the Moon's Apogee due to the same.

| Table XXI - 200 days S 30 guddias          | • | 1'     | 3° | 21'<br>53<br>3 | 53"<br>27<br>20<br>40 | 50<br>29         |
|--------------------------------------------|---|--------|----|----------------|-----------------------|------------------|
| Bijah for 300 days                         | • |        |    |                | 40                    | 48<br>53         |
| Place of the D's Apogce, 1st Chaitram 4924 | _ | 1 7    | 4  | 22<br>35       | 23<br>5.1             | 33               |
| Corrected place of the Moon's Apogee       | - | -<br>8 | 8  | <br>58         | 18                    | - <del>-</del> - |
|                                            | - |        | Ü  | ••             | •0                    | ŭ                |

Mean place of the Moon's Apogee on the proposed day.

at the time when the interculation was due.

Thus we have expounded that important Element by a comparatively short process, and with as much accuracy as if we had used the Sastra Rule.

Now observing that an intercalation was due on the 15th day of the 9th month of the year 4923 (8m 14d complete) and that at the same instant the Moon's Apogee was in 8° 58′ 18″ of the Sign Dhanus \$\mathcal{1}\$, corresponding with the Solar month Margali (one of the three short ones of the Solar year), whereas the Sun's Perigee was in 17° 17′ 18″ of the same Sign Dhanus (\*), there can be no doubt, from their near coincidence, that no two conjunctions can occur in the said month Margali; and that the Luui-solar month corresponding thereto is a Cshaya, or expunged month, and not an Adigah.

Conclusion for an expunsed month in the year 4924 of the Cali yug current.

The same circumstance may be argued, and the same results obtained for the years 4782 and 5064 complete, a notation which it is always necessary to keep in view when considering Hindu expressions; because the intercalation truly falls in the years Cali yugam 4783, and 5065 current. But as the Indians invariably make their computations for the end of the years, as well as of the Tidhis, those which their notation presents, imply always the year or Tidhi which has last expired; the fractional part of the quantities belonging to the ensuing ones.

The same for 4783 and 5065 current.

But if we come to convert the years so expressed into European time, then as the new Hindu year generally commences (as it has done for many centuries past) during the first months of the European concurring years, the intercalations and omissions, mostly fall in the course of the same Christian year.

In reading the columns of the second General Table, if we seek the character of the Hindu year

<sup>(\*)</sup> The Sign Dhanus being the 9th current, the Perigee is in 8s 17° 17' 17" 54" because the Sun's Λ pogee was at that time in 2s 17° 17' 15" 54" (vide page 83),

Notation of the Adigah and Cahaya years in the Ild General Table. which falls opposite to A. D. 1322, and which happens to be A. Cali yugam 4923, we are therefore to understand that the latter ended in 1822, and being marked AC in the fith column, that the intercalation and omission fall in 4921 current; but that not with standing the change in the notation of the Hindu year, these Equations are still introduced during the course of A. D. 1822. It must be acknowledged that this method of noting a year by its end, instead of its commencement, is somewhat incommodious, and liable to occasion mistakes; but it could not be altered without departing from the manner of computing of the Indians, which in matters that concernthem and their Tables we are bound to preserve.

Such is the preparatory method used by Hindu Almanac makers for approximating the recurrence of the Adigah and Cshaja months, before entering into the actual computation of the same. It might have been curious to ascertain what is the greatest distance of the Solar Perigee from the Lunar Apogee necessary to cause an expunged Lunation; but I am not aware that this research would lead to any useful purpose. That circumstance occurs very rurely, and as the Indians in their approximations (besides their calculating the place of the Moon's Apogee) resort also to the probable evidence of the Cycles of 19, 141 and 160 years, I shall leave the resolution of that problem to those who may be curious in abstract speculations, the limits of certainty being sufficiently narrowed by the foregoing two rules for all practical purposes.

19, 141 and 169 years, the three Cycles in which a Cshuya year may recur.

I shall close this Memeir by giving a last and complete resolution of the Cshaya year and month which are to occur at the period nearest to our times, by all the short rules which have been disclosed in the course of it. For this purpose we must begin by constructing the Skeleton of the Solar Kalendar for the year 5065 current (\*) (A. D. 1963), as was done for A. Cali yugam 4924 current, which fell 141 years before; but as some of the articles are constant, all that we require now, is a Table of the Initial Roots of, and duration, of its months, which are variable. Dominical Letter A. D. 1963, F. Dominical Letter A. D. 1964, ED.

Skeleton of the Solar Kalendar for the year 5060 of the Cali yig current.

| European<br>dates of<br>beginning of<br>Solar mouths | Names of Solar months. | Initial Roots of           | Sydercal<br>duration<br>of months | Cjvil du-<br>ration of<br>monthe. | Names and order of Zadiacal Signs. | Types or Signs.    | Signs<br>current. | Signs<br>complete. |
|------------------------------------------------------|------------------------|----------------------------|-----------------------------------|-----------------------------------|------------------------------------|--------------------|-------------------|--------------------|
| 14 March                                             | Poongoni 5064          | (4) 28 17 43               |                                   |                                   | Min                                | ×                  | 12                | 11                 |
| 13 April                                             | Chaitram 5065          | (6) 48 38 45               | 30                                | 31                                | Mesha                              | r                  | 1                 | 0                  |
| 11 May                                               | Vyassei                | (2) 44 10 46               | 31                                | 31<br>31                          | Vrisha<br>Midhuna                  | ß                  | 2                 | 1                  |
| 15 June                                              | Auni                   | (6) 8 22 47<br>(2) 45 0 48 | 31                                | 32                                | Carcata                            | 11.                | 3 4               | 2                  |
| 16 July<br>17 August                                 | Audi<br>Auyani         | (6) 13 12 50               | 32                                | 31                                | Tinha                              | $\frac{\Omega}{2}$ | 5                 | 1                  |
| 17 Septem.                                           | Paratasi               | (2) 15 22 51               | 31                                | 31                                | Canya                              | me                 | 6                 | 5                  |
| 17 October                                           | Arpesi                 | (4) 42 41 52               | 30                                | 31                                | Tulá                               | i ŝ                | 7                 | 6                  |
| 16 Novem.                                            | Cartiga                | (6) 36 51 53               | 30                                | 30                                | Vrischica                          | m                  | 8                 | 7                  |
| 16 Decem.                                            | Margali                | (1) 7 15 55                | 30                                | 29                                | Dhanus                             | 1                  | 9                 | 8                  |
| 15 January                                           |                        |                            | 29                                | 29                                | Macara                             | \ns                | 10                | 9.                 |
| 13 kebruary                                          |                        | (3) 55 24 57               | 29                                | 30                                | Cumb'ha                            | <b>**</b>          | 11                | 10                 |
| 13 March                                             | Poongoni               | (5) 43 48 58               | 30-                               | 30                                | Min                                | ×                  | 12                | 11                 |
| 13 April                                             | Chaitram 5066          | (1) 4 10 0                 | 31                                | 30                                | Mesha                              | r                  | 1                 | 0.                 |

### ARTICLE THE LAST.

Resolution of the double interculation with an expunsed month which is to occur at the nearest period to present times, reduced to the Geographical position of Madras.

By the Vakiam Tables and Solar process.

Although the present article contains no new doctrine, but merely applies to a particular case those which have already been disclosed, yet after due consideration of the expediency of retrenching it from the body of this work on that score, I have suffered it to remain as a document which predicts a remote contingency; the only one of its kind that can possibly occur before 140 years have revolved. What follows may therefore interest the philosophers of the twentieth century, if these imperfect but elaborate pages live to that extent of time.

The Rule for determining the Epochs of mean intercalations given at page 152, has warned us that a mean intercalary Lunar month will be due in the ninth month of the 5065th Solar year of the Cali yug (1886 Saca); and as on the beginning of that year the Sun's Apogee will lie in 2 17° 17′ 34″ of the Hindu Sydereal Zodiac; and as the Ayanansa on the 1st Chaitram of the same year (13th April 1963) will be 21° 51′ 19″, the said 9th month, (that of Margali) will still be one of the three short months of the Solar year. The Lunar intercalation which is due at that time, cannot therefore be introduced in that specific month, particularly if the Moon's Apogee happens then to lie near the middle of any of the three Zodiacal Signs Vrischica M, Dhanus 1, or Macara vs.

The Rule for intercalating announces an Adigah in the 9th month of the 5065th year of the Cali yug.

The 9th month of the said year still one of the 3 shortest months.

Having computed that Element by means of Vavilala Cuchinna's Index and Tables, as shewn at page 153, and found it to lie, on the 10th Margali 5065, in 7°11°36′9″12″; and the precise time of mean intercalation above referred to, being 5064y 8m 10d 0s 10v; knowing also that the Sun will complete its 8th Sign on the 1st Margali, we may conclude from these joint considerations, that the Lunar month which will happen to coincide with that of Margali instead of an Adigah, will on the contrary be a Cshaya month.

The Moon's Apogee in 7s 11° 36′ 9″ on the 10th Margali.

On this supposition if we proceed according to the Vakiam process, we shall find the following Elements.

## SECTION I.

The Solar Ahargana on the 1st Margali 5065, by the Ariah Siddhanta (Table XLVIII, part 2) is 1849914<sup>4</sup> 7<sup>g</sup> 15<sup>r</sup> 55<sup>r</sup>, and the Lunar, at the expiration of the 9th Lunation of the corresponding Luni-solar year, by the Surriah Siddhanta (Table XLIX, part 1) 1849914. The Soota dina or initial feria of the Solar month Margali is Soma-vara, or Monday (Kalendar, page 156).

Elements of 1st conjunction at the end of Cartigu.

| at<br>:u:                    | ⊙'s apparent place -         |          | -     | -   | -        | 7' | 29* | 52' | 517 |
|------------------------------|------------------------------|----------|-------|-----|----------|----|-----|-----|-----|
| 2065 at<br>Lanca             | His true motion              | -        |       | _   | -        |    | 1   | 1   | 23  |
| 37                           | b's apparent place (her C    |          |       |     |          |    |     |     |     |
| 1st Margali ?<br>Sun rise at | Druva 7' 4' 28' 3'; Equat    | ion 0' z | 4, 2, | C"; | and Arca |    |     |     |     |
| ရှိ<br>၁                     | Shagábala — 1' 27")          | ~        | -     |     | •        | 7  | 23  | 35  | 36  |
| Ti,                          | Her true motion -            | -        |       | •   | -        |    | 12  | 6   | 0   |
| t a                          | ∫ ⊙ and )'s distance         | •        | -     | -   | •        |    | 1   | 17  | 18  |
| हु <u>इ</u>                  | CRelative motion             | -        | -     |     |          |    | 11  | 4   | 27  |
|                              | And the time due to distance | <b>:</b> | -     |     |          |    | 6:  | 58* | 17% |

And as the Sun at his rising at Lanca will be more advanced than the Moon, the last result indicates the time that will be wanting of the instant of conjunction at that moment, and shows that the Amavasya will occur after Sun rising.

| But the Sun (Kalendar, page 156) will enter the Sign Dhanus # on | G.         | ٧. | P. |
|------------------------------------------------------------------|------------|----|----|
| the 1st Margali, after its rising, at                            | 7          | 15 | 55 |
| From which subtract time of Amarasya -                           | 6          | 58 | 17 |
| Time before the commencement of the Sydercal Solar month         | <b>-</b> 0 | 17 | 38 |

Time of conjunction before the commencement of the Sydereal month Margali.

So that the Amavasya will take place at Lanca, not in the Solar Sydereal month Margali, but on the last Sydereal day of Cartiga.

## SECTION II.

# Second Amavasya.

After having added to the foregoing Solar Ahargana, the absolute duration of the Solar month Margali, as given in Table III, the Solar Ahargana will be 1849943<sup>1</sup> 28<sup>2</sup> 8<sup>2</sup> 56<sup>2</sup>; but as in the present position of the Sun and Moon's Apogees the Lunar Synodical, is longer than the Solar month Margali, we are to add one day more thereto, and the Ahargana to be used will be 1849941 corresponding to the 2d Tye 5065, which, proceeding as usual, will be found to fall on a Wednesday or Bhuda-vara. But it will be more expeditious to dispense with the Ahargana, and use the short process indicated at page 147. By either way, however, the Elements for the 2d Amayasya will be found to be as follows:

Elements of 2d conjunction in the beginning of Tye.

| # # ·            | (O's apparent place | -            | •        | -       | -                | 9, | 0. | 32' | 35*        |
|------------------|---------------------|--------------|----------|---------|------------------|----|----|-----|------------|
| 5065 а.<br>Lanca | His true motion     | -            |          | -       | -                |    | 1  | 1   | 23         |
| £ 2              | )'s apparent place  | (the Chand   | ra Vakia | m being | 32; her          |    |    |     |            |
| ä.               | Druva, the same     | as for the p | receding | month,  | 7' 4" 28'        |    |    |     |            |
| E : ≥c <         | 3"; Equation 1"     | 27° 30′ 0    | "; and   | Arca Bl | hagábal <b>a</b> |    |    |     |            |
| ed Tyising       | -1' 7''             |              | •        |         | •                | 9  | 1  | 56  | 5 <b>6</b> |
| On the<br>Sun r  | Her true motion     |              | -        | ~       | -                |    | 12 | 28  | 0          |
| Sur th           | O and D's distance  | • •          | •        | •       | •                |    | i  | 24  | 21         |
| ŌĨ.              | Relative motion     | -            | -        | •       | -                |    | 11 | 26  | 37         |
|                  | And the time due to | distance     | _        |         | -                |    | 7: | 221 | 10*        |

As the Moon is more advanced than the Sun, the last quantity shews the time that will be elapsed at Sun rise since the conjunction has taken place.

| Therefore from                                                                             | •          | -            | -          | -<br>Subtr | ac <b>t</b> | 6.<br>60<br>7  | v.<br>22 | r.<br>10       |
|--------------------------------------------------------------------------------------------|------------|--------------|------------|------------|-------------|----------------|----------|----------------|
| End of Amarasya Ti                                                                         | dai, 1st T | ye, after Su | n rise a   | t Lanca    | -           | 52             | 37       | 50             |
| But it appears by the Kalend<br>Sign Micara v9 on the 1st<br>If therefore we retrench this | Civil day  | of Tye, af   | ter Sun    | rise, at   | -           | G.<br>28<br>52 | v.<br>3  | P.<br>56<br>50 |
| it meterore we retreated this                                                              | ame irom   | that of the  | e "Liliaya | isy a      | •           | 24             | 28       | 51             |

we have the time elapsed between the Sun entering the new Sign, and that when the conjunction is to occur.

Time of conjunction after the Sun has entered the Sign Macara VP.

#### Conclusion.

We have seen in the preceding article, that the last conjunction was to happen on the last Sydereal day of the Solar month Cartiga (page 158) at 17' 38° before the Sun entering the Sign Dhanus f, and by the present operation, that the ensuing one will fall 24' 28' 54° after he was to leave it; therefore it happens that no change will take place during the whole of the Solar Sydereal month Margali f, and that under the Meridian and Latitude of Lanca, the Lunissolar year 5065 will be a Cshaya, or double intercalary year.—From which we conclude, that as the Lunar month Aswina of the same year must in consequence be an Adigah, or intercalated month, (page 149); Margasiras (also called Agrahayan) which would concur with Margali, should be expunged out of the Chandra Panchangum for that place.

No conjunction during the time that the Sun remains in the Sign Dhanus I.

Therefore the Lunar month Margasiras to be expunged out of the Kalendar for A. Cali yug 5065 at Lunca.

### SECTION III.

Having now obtained the certainty that the 5065th year of the Califyrg is a Cshaya year for Lanca, we are to determine whether it be equally so for Madras; and for this we have the following

The conjunction in Cartiga referred to the Meridian and Latitude of Madras.

### DATA.

| Latitude of Madras or A   | esha B    | agaks (Ta | able X | (IIIXX | •       | 13 | • 4  | ,        |
|---------------------------|-----------|-----------|--------|--------|---------|----|------|----------|
| Longitude of do. or Da    |           |           |        |        | -       |    | 65   | E.       |
|                           |           | Mean      | Time   | •      | -       | 47 | _    | E.       |
| 77 1 11 17 17 27 27       |           |           |        |        | Angulas | ١. | Vinc | ulas.    |
| Equinoctial Shadow or P   |           |           | XXIV)  | -      | 2       | _  | 47   | <i>7</i> |
| Ayanansa, Ist Margali 50  | 065 (*)   | -         | -      | -      |         | 21 | 581  | 3"       |
| ⊙'s apparent place at Sun | ı rise at | Lanca     |        | •      | 7°      | 29 | 52   | 54       |
| True motion               | -         | •         | •      | •      |         | 1  | 1    | 23       |
| )'s apparent place at do. |           | -         | •      | •      | 7       | 28 | 35   | 36       |
| True motion               | •         | -         | -      | -      |         | 12 | 6    | O"       |

Ayanansa, 1st Margali A. Cali yuz 5065

N. B.—The same may be obtained much quicker by Table XXXV.

#### OPERATION.

The C's true motion on the 1st Margali being 61' 23", and the Longitude of Madras in time being 47° 4° East, the Equation due to that interval of time is — 48", and consequently the Sun's apparent place at time of mean Sun rising at Madras is 7° 29° 52′ 6".

The D's true motion on the same day being 12° 6', and the Longitude as before, the Equation due to the same is — 9° 29°, and the Moon's apparent place on the 1st Margali at time of mean Sun rising is 7° 23° 26′ 7°. The © and D's true distance is 1° 25′ 59″; the relative motion 11° 4′ 37″, and the time due to distance 7′ 45° 44°, which, because the Moon was less advanced than the Sun, marks the time wanting of the conjunction at mean Sun rising at Madras.

## Section IV.

We are now to compute the time of true Sun rising at the proposed place on the said 1st Margali, so as to express the time of conjunction with reference to that instant; and for the resolution of that problem, we have recourse to what has been said in the second part of this Memoir on Hindu Gnomonics.

Although we have already given an example of the application of these doctrines when computing the end of the 30th or last Amavasya Tidhi of the year 4923 of the Cali yug, yet as other matters have intervened, one example more, of a rather intricate proposition, may not be superfluous for those who may be desirous of making further progress in Hindu Astronomy.

Λ

The Sun and Moon's places referred to the Tropical Sphere, For the Ravi Sayana, or Sun's Longitude on the Tropical Sphere.

| O's Sputa Graha, 1st Margali<br>Ayanansa on the same day | - |   | - |   | 29°<br>21 | 52 <b>′</b><br>58 | 6**<br>3 |
|----------------------------------------------------------|---|---|---|---|-----------|-------------------|----------|
| Ravi Sayana, 1st Margali, at Madra                       | s | • | - | 8 | 21        | 50                | y        |

·B

For the *Utlagna* of Madras, or Arc of the Equator which rises above the Horizon with the Sun, being what the Hindus call the *Sputa* or true quantity which determines the Sun's diurnal motion in oblique ascension.

Diurnal motion of the Sun in oblique ascension, By article 50, Section II, Problems A and B of Gnomonics, page 104, we have

As 30° (1800 calas) to 1980 calas, (the Ullagna of Madras for 9 Signs, Table XLVI), So 61'

23' (the Sun's true motion in Longitude), To  $\frac{1980' \times 61' \cdot 23''}{1800} = 67' \cdot 30'' \text{ the Sun's diurnal motion}$ in oblique ascension, required.

C

For the length of the Savan or natural day.

We have already observed that as there are 216000 pranacalus (6 in a vicala) in a natural days

and the same number of calas (minutes of a degree) in the Equatorial Circle, or 360°; these 67 calas, 30 vicalas, represent pranacalas in time; therefore if we divide by 6, or  $\frac{67.30^{\circ}}{0}$ , we have 1st 57 = 11vic. 1pra.; and 2d, 60: 30" :: 10 (castacalas): 5. Hence the Equation sought is 11vic. 1,5pra. to be added to the mean Sydereal day.

The length of the Savan day required is therefore 60 dan. 11 vic. 1,5 pran. expressed in Murta time.

Length of the natural day in Murta time.

For the length of the artificial day or time of the Sun being above the Horizon on the 1st Margali 5065 current.

 $\mathbf{A'}$ 

The length of the natural or Bhumi Savan day being 60 dan. 11 pal. 1,5 pran., its fourth part, is 15 dan, 2 pal. 4,9 pran. (\*) or 15° 2° 49°, being one half the mean artificial day and night.

The same in Solar

To have the true duration of each we are to find the Sun's Declination, or Cranti Bagahs, and Ascensional difference, or Chara Cumda.

For the Sun's Declination (Gnomonics, Sect. II, para. 60 B, page 105).

The Ravi-Sayana (A, preceding page) 21° £0′ 9″ The Sine of which is 3402' 24 The Obliquity of the Ecliptic (constant) And its Sine or Paramapa-Cramajya 1397'

Then say

: Radius 3133: Sine Sun's Longitude 3402':: Sine Obliquity 1397': \frac{3402\times 1397'}{3458'} = 1382' the The San's Declina.

Sine of the Cranii Bugahs, or Declination sought, corresponding to an Arc of 23° 43' South.

For the Chara Cumda, or Ascensional difference (Gnomonics, Sect. II, 69 C, page 105).

DATA.

Sinc. Cosine. The Altitude of the Poic is 13° 4' its 777' 3318' The Sun's Declination 23° 43' South 1382' 3148'.

Say 10 (Cos. 13° 4') 3348': (Sine Do.) 777':: (Sine 23° 43') 1331':  $\frac{1391 \times 777'}{33.18'} = 320'$ the Cshctijya, being the first approximation.

2º (Cosine 23° 42') 3148': (Cshetijya) 320':: (Radius) 3438: 3188' = 349', the Chara, or Ascensional difference sought, which converted into time by Table XXXI, answer to 58' 10°.

Ascensional difference.

<sup>(\*)</sup> Because in a vicula or pala there are 6 pranacaias, and that in a viguddia there are 60 paras.

For the Dinarda and Ratri-Arda, or half the artificial day and night on the 1st Margali at Madras. (Gnomonics, Sect. II, 60 D, page 163).

#### A"

|                                                                   | $\mathbf{A''}$                                                                                                                                                              |
|-------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                   | Because the Sun's Declination is South, from the fourth part c. v. r. of the natural day (A', preceding page) - 15 2 49 Subtract Chara in time (C', preceding page) - 53 10 |
|                                                                   | Dinarda, or half artificial day - 11 4 39                                                                                                                                   |
|                                                                   | And for the night                                                                                                                                                           |
|                                                                   | Ratri-Arda, or half artificial night - 16 0 49                                                                                                                              |
|                                                                   | B*                                                                                                                                                                          |
| rtificial day and<br>ight.                                        | The Dina, or entire day, is therefore $2 \times 14^{\circ} 4^{\circ} 39^{\circ}$ . 28 9 18 And the Ratri or entire night . $2 \times 16$ 0 49 . 32 1 38                     |
|                                                                   | C*                                                                                                                                                                          |
|                                                                   | For the true time of Sun rising.  The time of noon is always expressed by - 75 0 0                                                                                          |
|                                                                   | The time of moon is always expressed by - 75 0 0 Subtract Dinarda - 14 4 39                                                                                                 |
| True time of Sun<br>rising at Madras,                             | 60 gud. + Equation of time, that of Sun rising at Madras on the 1st Margali - 60 55 21 Add the whole Dina or artificial day - 28 9 18                                       |
|                                                                   | True time of Sun setting on do 29 4 39                                                                                                                                      |
|                                                                   | D"                                                                                                                                                                          |
|                                                                   | It was found, page 160, that the conjunction will occur at Madras after mean Sun rise at  But the San rises truly on the 1st Margali at Madras after 60                     |
|                                                                   | guddias (C', present page) 55 21                                                                                                                                            |
|                                                                   | $\mathbf{D} \mathbf{ifference} \qquad 6 50 23$                                                                                                                              |
| Conjunction after                                                 | which shows that the Amavasya will fall at 6° 50° 23" after true Sun rising at Madra                                                                                        |
| true time of Sun<br>rising, 1st Margali.                          | 1st Margali 5065.                                                                                                                                                           |
|                                                                   | When the Sun entered the Sign Dhanus ‡, at Lanca (Kalendar, c. v. r. page 156), at - 7 15 55  Add Desentara in time - 47 4                                                  |
|                                                                   | It was mean time at Madras - 8 2 59 Subtract Equation of time (C') - 55 21                                                                                                  |
| Time of conjunction<br>before Sydereal be-<br>ginuing of Margali, | Time of ©'s entrance in $f$ after true Sun rising - 7 7 38 Time of conjunction above found - 6 50 23                                                                        |
| - · ·                                                             | Time before Sydereal commencement of Margali ‡ - 17 15 That which was found at page 158 (being computed for Lanca) was 17 38                                                |

Difference

# Second Amavasya.

The process being absolutely the same, I shall only give the results.

Results of reductions of the 2d conjunction in the Solar month Tye.

| :- T - :                                                  |                                                                                                    | C 4744 40                                                                                                                                                           | Trojr                                                                                                                                                                    |                                                                                                                                                                                    |                                                                                                                                                                                           | OF 01                                                                                                                                                                                                                                   | . 4 100                                                                                                                                                                                                                                                                                       |
|-----------------------------------------------------------|----------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| in 170në                                                  | gituae o                                                                                           | 1 47' 4"                                                                                                                                                            | E. 2d T                                                                                                                                                                  | ye buda                                                                                                                                                                            |                                                                                                                                                                                           | 0° 31                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                               |
| -                                                         | _                                                                                                  |                                                                                                                                                                     | _                                                                                                                                                                        | • -                                                                                                                                                                                | •                                                                                                                                                                                         |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
|                                                           | •                                                                                                  | •                                                                                                                                                                   | •                                                                                                                                                                        |                                                                                                                                                                                    |                                                                                                                                                                                           |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                           | G. V.                                                                                                                                                                                                                                   |                                                                                                                                                                                                                                                                                               |
| ı before                                                  | e Sun ri                                                                                           | sing of 9                                                                                                                                                           | 2d Tye                                                                                                                                                                   | •                                                                                                                                                                                  | -                                                                                                                                                                                         | 6 3                                                                                                                                                                                                                                     | 14                                                                                                                                                                                                                                                                                            |
|                                                           |                                                                                                    | lo.                                                                                                                                                                 | •                                                                                                                                                                        | •                                                                                                                                                                                  | -                                                                                                                                                                                         |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
| ue asce                                                   | nsion                                                                                              | -                                                                                                                                                                   | -                                                                                                                                                                        | •                                                                                                                                                                                  |                                                                                                                                                                                           |                                                                                                                                                                                                                                         | <u>-</u>                                                                                                                                                                                                                                                                                      |
| to Mur                                                    | tu tima                                                                                            |                                                                                                                                                                     | _                                                                                                                                                                        |                                                                                                                                                                                    | dan.                                                                                                                                                                                      | _                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                               |
|                                                           |                                                                                                    |                                                                                                                                                                     | · .                                                                                                                                                                      | •                                                                                                                                                                                  | - 60                                                                                                                                                                                      |                                                                                                                                                                                                                                         | 4,4                                                                                                                                                                                                                                                                                           |
|                                                           |                                                                                                    |                                                                                                                                                                     | -                                                                                                                                                                        | -                                                                                                                                                                                  | 00                                                                                                                                                                                        | 10                                                                                                                                                                                                                                      | 4,4                                                                                                                                                                                                                                                                                           |
|                                                           |                                                                                                    |                                                                                                                                                                     | don                                                                                                                                                                      | -:                                                                                                                                                                                 | _                                                                                                                                                                                         |                                                                                                                                                                                                                                         | _,                                                                                                                                                                                                                                                                                            |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                           |                                                                                                                                                                                                                                         | <b>P</b> .                                                                                                                                                                                                                                                                                    |
| 4                                                         | <u> </u>                                                                                           | -                                                                                                                                                                   | <b>-</b> 15                                                                                                                                                              | 2 4,1                                                                                                                                                                              | or 15                                                                                                                                                                                     | 5 2                                                                                                                                                                                                                                     | 41                                                                                                                                                                                                                                                                                            |
| ı                                                         | _                                                                                                  | -                                                                                                                                                                   | -                                                                                                                                                                        | -                                                                                                                                                                                  | _                                                                                                                                                                                         | 22°                                                                                                                                                                                                                                     | 3 <b>′</b>                                                                                                                                                                                                                                                                                    |
| •                                                         | -                                                                                                  | -                                                                                                                                                                   | -                                                                                                                                                                        | -                                                                                                                                                                                  | -                                                                                                                                                                                         | -                                                                                                                                                                                                                                       | 209                                                                                                                                                                                                                                                                                           |
| -                                                         | •                                                                                                  | -                                                                                                                                                                   | -                                                                                                                                                                        |                                                                                                                                                                                    |                                                                                                                                                                                           |                                                                                                                                                                                                                                         | 322                                                                                                                                                                                                                                                                                           |
| da in d                                                   | egrees                                                                                             | •                                                                                                                                                                   |                                                                                                                                                                          | •                                                                                                                                                                                  |                                                                                                                                                                                           | 5                                                                                                                                                                                                                                       | 20                                                                                                                                                                                                                                                                                            |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                           | ٧.                                                                                                                                                                                                                                      | P.                                                                                                                                                                                                                                                                                            |
| Table                                                     | XXXI                                                                                               | ,                                                                                                                                                                   | ~                                                                                                                                                                        | -                                                                                                                                                                                  | -                                                                                                                                                                                         | 53                                                                                                                                                                                                                                      | 20                                                                                                                                                                                                                                                                                            |
| 1.                                                        |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                           |                                                                                                                                                                                                                                         | P.                                                                                                                                                                                                                                                                                            |
| -                                                         | -                                                                                                  | ~                                                                                                                                                                   | -                                                                                                                                                                        | -                                                                                                                                                                                  |                                                                                                                                                                                           |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
|                                                           |                                                                                                    | •                                                                                                                                                                   | •                                                                                                                                                                        | •                                                                                                                                                                                  | -                                                                                                                                                                                         |                                                                                                                                                                                                                                         | _                                                                                                                                                                                                                                                                                             |
|                                                           |                                                                                                    | •                                                                                                                                                                   | •                                                                                                                                                                        | •                                                                                                                                                                                  |                                                                                                                                                                                           |                                                                                                                                                                                                                                         | 21<br>1                                                                                                                                                                                                                                                                                       |
| MI CILICIU                                                | gut                                                                                                | •                                                                                                                                                                   | •                                                                                                                                                                        | •                                                                                                                                                                                  |                                                                                                                                                                                           | • •                                                                                                                                                                                                                                     | 4                                                                                                                                                                                                                                                                                             |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          |                                                                                                                                                                                    |                                                                                                                                                                                           |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
|                                                           | S WE CO                                                                                            | me to it                                                                                                                                                            | e fallow                                                                                                                                                                 | ing con-                                                                                                                                                                           | -Insians                                                                                                                                                                                  |                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                               |
| e resurt                                                  | s we con                                                                                           | me to th                                                                                                                                                            | ie fellow                                                                                                                                                                | ing con                                                                                                                                                                            | clusions.                                                                                                                                                                                 | •                                                                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                               |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          | ing con                                                                                                                                                                            | G                                                                                                                                                                                         | . v.                                                                                                                                                                                                                                    | P,                                                                                                                                                                                                                                                                                            |
| oon tim                                                   | s we con<br>ne being                                                                               |                                                                                                                                                                     |                                                                                                                                                                          | ing con                                                                                                                                                                            | <b>-</b> 7.                                                                                                                                                                               | <b>v.</b> 5 0                                                                                                                                                                                                                           | o                                                                                                                                                                                                                                                                                             |
|                                                           |                                                                                                    |                                                                                                                                                                     |                                                                                                                                                                          | ing con                                                                                                                                                                            | G                                                                                                                                                                                         | <b>v.</b> 5 0                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                               |
| oon tim<br>ing                                            | ne being                                                                                           | always                                                                                                                                                              |                                                                                                                                                                          | •                                                                                                                                                                                  | - 7.<br>14                                                                                                                                                                                | v.<br>5 0<br>4 9                                                                                                                                                                                                                        | 0<br>21                                                                                                                                                                                                                                                                                       |
| oon tim<br>ing<br>+ the                                   | e being<br>-<br>Equation                                                                           | always                                                                                                                                                              | ne for Si                                                                                                                                                                | •                                                                                                                                                                                  | - 7.<br>14<br>- 60                                                                                                                                                                        | v.<br>5 0<br>4 9                                                                                                                                                                                                                        | 0<br>21<br>39                                                                                                                                                                                                                                                                                 |
| oon tim<br>ing<br>+ the                                   | ne being                                                                                           | always                                                                                                                                                              | ne for Si                                                                                                                                                                | •                                                                                                                                                                                  | - 7.<br>14                                                                                                                                                                                | v.<br>5 0<br>4 9                                                                                                                                                                                                                        | 0<br>21                                                                                                                                                                                                                                                                                       |
| oon timing  + the                                         | e being - Equation of                                                                              | always<br>on of tin<br>artifici                                                                                                                                     | ne for Si<br>al day                                                                                                                                                      | •                                                                                                                                                                                  | - 7.<br>14<br>- 60                                                                                                                                                                        | v.<br>5 0<br>1 9<br>50<br>3 18                                                                                                                                                                                                          | 0<br>21<br>39<br>42                                                                                                                                                                                                                                                                           |
| oon timing  + the                                         | e being<br>-<br>Equation                                                                           | always<br>on of tin<br>artifici                                                                                                                                     | ne for Si<br>al day                                                                                                                                                      | •                                                                                                                                                                                  | - 7.<br>14<br>- 60<br>28                                                                                                                                                                  | v.<br>5 0<br>1 9<br>50<br>3 18                                                                                                                                                                                                          | 0<br>21<br>39                                                                                                                                                                                                                                                                                 |
| oon timing  + the                                         | e being - Equation of                                                                              | always<br>on of tin<br>artifici                                                                                                                                     | ne for Si<br>al day                                                                                                                                                      | •                                                                                                                                                                                  | - 7.<br>14<br>- 60<br>28                                                                                                                                                                  | v.<br>5 0<br>1 9<br>50<br>3 18                                                                                                                                                                                                          | 0<br>21<br>39<br>42                                                                                                                                                                                                                                                                           |
| oon timing the or dura                                    | e being  Equation of un rise of                                                                    | always<br>on of tin<br>artifici                                                                                                                                     | ne for So<br>al day<br>2d Tye                                                                                                                                            | -<br>un rising                                                                                                                                                                     | 7. 12<br>60<br>28                                                                                                                                                                         | v.<br>5 0<br>4 9<br>5 50<br>3 18                                                                                                                                                                                                        | 0<br>21<br>39<br>42<br>21                                                                                                                                                                                                                                                                     |
| oon timing  + the or duranteer So                         | Equation of un rise or true Su                                                                     | always on of tir artifici on the S                                                                                                                                  | ne for Si<br>al day<br>2d Tye<br>3 at Mad                                                                                                                                | in rising                                                                                                                                                                          | 7. 14<br>60<br>28<br>- 29                                                                                                                                                                 | v. 50 0 50 3 18 9 9                                                                                                                                                                                                                     | 9<br>21<br>39<br>42<br>21                                                                                                                                                                                                                                                                     |
| oon timing  + the or dura  after So on after              | Equation of un rise of true Suntime of                                                             | always on of tir artifici on the S                                                                                                                                  | ne for So<br>al day<br>2d Tye                                                                                                                                            | in rising                                                                                                                                                                          | 7. 7. 60 28 22 22 the 1st 'Cye G.                                                                                                                                                         | v. v. 55 0 0 4 9 0 50 3 18 9 9 9 V.                                                                                                                                                                                                     | 0<br>21<br>39<br>42<br>21<br>21                                                                                                                                                                                                                                                               |
| oon timing  the or dura after Se on after er mean         | Equation of un rise of true Sun time of ras                                                        | always on of tit artifici on the 5 un rising                                                                                                                        | ne for Si<br>al day<br>2d Tye<br>3 at Mad                                                                                                                                | in rising                                                                                                                                                                          | 7. 14<br>60<br>28<br>- 29                                                                                                                                                                 | v. v                                                                                                                                                                                                | 0<br>21<br>39<br>42<br>21<br>21<br>65.                                                                                                                                                                                                                                                        |
| oon timing  the or dura after Se on after er mean         | Equation of un rise of true Suntime of                                                             | always on of tit artifici on the 5 un rising                                                                                                                        | ne for Si<br>al day<br>2d Tye<br>3 at Mad                                                                                                                                | in rising                                                                                                                                                                          | 7. 7. 60 28 22 22 the 1st 'Cye G.                                                                                                                                                         | v. v. 55 0 0 4 9 0 50 3 18 9 9 9 V.                                                                                                                                                                                                     | 0<br>21<br>39<br>42<br>21<br>21                                                                                                                                                                                                                                                               |
| oon timing  the or dura after So on after er mean at Made | Equation of un rise of true Sun time of ras, subtr.                                                | always on of tit artifici on the 2 un rising Sun ris                                                                                                                | ne for Si<br>al day<br>2d Tye<br>3 at Mad                                                                                                                                | an rising                                                                                                                                                                          | 7. 14 60 28 - 22                                                                                                                                                                          | v. v                                                                                                                                                                                                | 0<br>21<br>39<br>42<br>21<br>21<br>65.                                                                                                                                                                                                                                                        |
| 1 Cris                                                    | before ise on the ascente Murday at the following the following the ficial dartificial dartificial | before Sun rise on the 1st one ascension to Murtu time day at Madras ral day; d. c. pra. 60 10 4,4  da in degrees  Table XXXI lay night ficial day artificial night | before Sun rising of sise on the 1st do. ue ascension to Murta time day at Madras in do. tral day; d. c. pra. 60 10 4,4  da in degrees  Table XXXI, lay night ficial day | before Sun rising of 2d Tye ise on the 1st do. ue ascension  to Murta time day at Madras in do. iral day; d. c. pra. 60 10 4.4 15  da in degrees  Table XXXI, lay night ficial day | before Sun rising of 2d Tye ise on the 1st do. ue ascension  to Murta time day at Madras in do. iral day; d. c. pra. 60 10 4.4 15 2 4,1  da in degrees  Table XXXI,  lay night ficial day | before Sun rising of 2d Tye ise on the 1st do. ue ascension  to Murta time day at Madras in do. ral day; d. c. pra. 60 10 4.4 15 2 4,1 or 15  da in degrees  Table XXXI,  lay night ficial day  1 1 2 2 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 3 | 9 1 47 1 15 11 26 6. v. 6 before Sun rising of 2d Tye 6 38 ise on the 1st do. 10 dan. vicalas to Murta time day at Madras in do. 11 dan. vicalas dan. vicalas for 10 day 11 dan. vic. pra. 12 dan. vic. pra. 15 2 4,1 or 15 2 22°  da in degrees  Table XXXI,  12 day 13 18 16 idial day 14 9 |

### Conclusion.

Conclusion.

| By the Kalendar, page 156, the Sun will enter the Sign Maccon the 1st Civil day of Tye, at Lanca, after Sun rise, at Add Longitude in time |   | <b>G.</b><br>28 | <b>v.</b><br>8<br>47 | P.<br>56<br>4 |
|--------------------------------------------------------------------------------------------------------------------------------------------|---|-----------------|----------------------|---------------|
| The same at Madras after mean Sun rising Subtract Equation, preceding page                                                                 | - | 28              | 56<br>50             | 39            |
| Which remainder subtracting from time of conjunction above for                                                                             |   | 28<br>52        | 5<br>34              | 21<br>7       |
| Leaves the time of conjunction at Madras                                                                                                   |   | 21              | 28                   | 46            |

after the Sun will have left the Sign Dhanus I and entered Macara W.

The year 5065 of the Cali yug a Cshayant Madras as well as at Lanca.

It appears therefore, that the 5065th year of the Cali yug will have two intercalary, and one expunged, months at Madras, as well as at Lanca, because the first conjunction under consideration will occur at that place 17° 13° before the Sun enters the Sign Dhanus 1, and the second 24° 26° 46° after he has left it, which was to be determined.

#### OBSERVATION.

Delalande complains somewhere, that although the science of Astronomy has appeared to the greatest men of all ages a study worthy to be followed through life, yet he was often compelled to answer the following question "Of what use is Astronomy?"

In the same manner, after having waded through a mass of theories and computations, the seeming object of which was merely to determine two circumstances to which the Hindu Lunisolar account of time is subject, I expect that many a reader will ask "Of what utility is so "long and fatiguing a research?" especially since it has been observed that (with the only exception of the country called *Tellingana*) the custom of dating documents by the *Tidhis*, has long since been abrogated in all parts of India; and that even there, a Luni-solar Tidhi is never proposed as a date, without annexing thereto the concurring Solar Theidy.

To which I shall answer, as the French Philosopher did, that to do away an error widely diffused, and to remove ignorance from any post which has influence over the concerns of men, must be practically useful in all times and countries. When several years ago I was called upon to look into the Tellinga Kalendar, so little was its construction understood, that the best informed Gentlemen with whom I conversed, even some who from inclination and habits were best acquainted with Hindu learning and usages, entertained a belief that I might invent some sort of perpetual Kalendar of the Siddhanta Chandra Mana, which would supersede the necessity of referring to the Native Sastras on any question of time, and answer all the common purposes of office. Nay, after the present Memoir had already assumed some consistency, a scientific friend objected that it was rather a Tract on Hindu Astronomy than on the Kalendar, and recalled my attention to the original design of the research: But after a perusal of all

that he could collect on the same subject, he ultimately admitted (as I trust every person who has read with attention the preceding pages will) that any attempt to subject the contingencies of the Luni-solar years to any mechanical process, would be as hopeless a task as if it were proposed to elicit the articles of the English Nautical Almanac, or French Connoissance des Tems, by any other means than their regular computation.

One point has therefore been gained; namely, that of undeceiving several Gentlemen, well informed in other matters, on a subject respecting which they were much mistaken.

Lastly, if it be at any time of public importance to fix or expound dates according to Lunisolar account, having now disclosed the means by which these questions are resolved by the Native Sastras themselves, and (with the exception of a few particular contrivances invented by private Kalendar makers) the only ones that can answer the same end, I may be permitted to hope, that although the rules here given, be long and harassing in the extreme, yet the Key to the Siddhanta Chandra Mana has furnished an Instrument for Chronology which was hitherto unknown in this part of India.

END OF THE SECOND MEMOIR.

|   | • |  |
|---|---|--|
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   | 3 |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
| - |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |
|   |   |  |

# **APPENDIX**

TO THE

# KEY TO THE SIDDHANTA CHANDRA MANA.

# A COMMENTARY

ON

# VAVILALA CUCHINNA'S

RULES AND TABLES FOR COMPUTING THE TELLINGA KALENDAR.

Written in the year 1797.

|   |  | • |  |   |
|---|--|---|--|---|
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  |   |
|   |  |   |  | ř |
| • |  |   |  |   |
|   |  |   |  |   |

The following Commentary on Vavilala Cuchinna's Rules and Tables, is inserted here, rather as a Tract extremely remarkable, both for the singularity of the topics which it investigates, and for the ingenuity displayed in expounding them, than as an instrument which is likely to prove serviceable to the main object of these Memoirs. Such documents should be kept on record, although they be seldom referred to; because they may lead into unexpected discoveries, and teach better than any series of precepts, how to unravel the manner of reasoning of a people who have frequently found their way to truth by paths widely different from those usually followed by European philosophers.

It may be said of this Tract, that presented by itself, it would throw but little light on the theories of Hindu Astronomy. The contrivance of an arbitrary Index for using the Tables of the Planets, and other Elements, is in particular, calculated to throw a veil over the problems to be resolved, which nothing short of the penetration and perseverance of the scholiast who undertook the trying task of exploring them could ever have removed. But I trust that those who have perused the two first Memoirs of the Kala Sankalita, will find no difficulty in tracing back the rules contained in the following pages to their legitimate source.



•

·

.

# RULES AND TABLES

For computing the principal articles of the Hindu Luni-solar Kalendar for the Meridian of Lanca reducible to any other Meridian, communicated to A. Scott, Esq. by Josela Barcarjosey of the Village of Sutiaveram near Chicacole, in the year 1797. (\*)

# PART I.

1. On the last day of the Tellinga year which ended on the 28th March 1797 at noon, 4393 years of the Cali yug expired, and also 1719 years of the æra of Salivahana: the Epoch from which the computations commence is the end of the 1220th year of the æra of Salivahana, or Epoch, 499 years before the commencement of the present Tellinga year.

2. To find the number of days elapsed from the given Epoch to the beginning of the Tellinga Ahargana from year answering to the 28th March 1797 at noon.

| 10                         | 20                          |        | 30   | 4•                               |
|----------------------------|-----------------------------|--------|------|----------------------------------|
| 499                        | <b>5</b> 98 <b>3</b>        |        | 5988 | 6172                             |
| 12                         | 86                          |        | 184  | ,<br>30.                         |
| 5988                       | 6074                        |        | 6172 | 185160                           |
| 41                         | 15                          |        |      | <b>3</b> 0- <b>1</b>             |
| 70)6029(8 <b>6</b><br>6020 | <b>33</b> )6039(184<br>6072 | 1      |      | 708)185464( <b>261</b><br>134788 |
| 9                          | 17                          |        |      | 676                              |
| 5.                         |                             | бo     |      | 70                               |
| 135160                     |                             | 185160 |      | <b>7</b> )182263( <b>26037</b>   |
| 261                        |                             | 2897   |      | 182259                           |
| 185421                     |                             | 182263 |      | -1                               |
| 13                         |                             |        |      |                                  |
| 64)135431(\$               | 837                         |        |      |                                  |
| 185 103                    |                             |        |      |                                  |
| 26                         |                             |        |      |                                  |

It appeared on consideration, that the number 6172 found by the 3d operation, is that of the

<sup>(\*)</sup> The first part of this Tract refers to the XXXVIIIth, XXXIXth, XLth, and XL1st Tables.

Lanar months contained in 499 years; and that the number 182263 found by the 6th operation, is that of the number of days in the same period of years. The days divided by 7 shew that 26037 weeks had elapsed and four days over, and as the Epoch was on a Friday, the last day of the last Tellinga year fell on a Tuesday. From a consideration of the operations, I find that 385 years answer to 4762 Lunations, and that 7552 Lunations answer to 223015 natural days, without a remainder in either case. By combining these, it is found that 2907520 years answer exactly to 35302624 mean Lunations, and also exactly to 1061997430 natural days.

Ratio of the Sun's Zodia; al revolution to mean Lunation in the same.

It follows that one Zodiacal revolution of the Sun contains 12.3688312 mean Lunations; that a mean year or Zodiacal revolution of the Sun contains 365.2588563 days, that is 365 15 31 52 96 as the Indians reckon, or 365 6 12 45 18 as Europeans reckon; that one mean Lunation contains 29.5305879 days, that is 29 31 50 6.99, or 29 12 44 2.79; and that one mean Zodiacal revolution of the Moon contains 27.3216747 days, that is 27 19 18 1.66 or 27 43 12 66.

Tidhis or Luni-solar days.

A Tidhi or the 30th part of a Lunation is on a medium equal to 0.9843529 of a day, or to 5953' 40° 23, so that 64 mean Tidhis are nearly equal to 63 days. It also appears that 34 mean Lunations or Lunar months are nearly equal to 33 Solar mouths or 12th parts of the Sun's resolution in the Zodíac. Since the last Teilinga year ended 28th March 1797 N. S. or 17th March O. S. at noon, and since 182263 days had elapsed from the Epoch to the end of last year, it follows that the Epoch answers to Friday the 14th March 1298; for 182263 days make 499 Julian years, including 125 Bissextiles, and 3 days over.

For the Prathama or Padyami Tidhi.

3. To find the mean time of the first Tidhi Padyami's beginning, or in other words the mean time of new Moon.

This is only a continuation of the computation at the beginning of the last article; by that the day of the new Moon was found, but this serves for finding the time of the day.

| · ·           |          |      | •  |      |  |
|---------------|----------|------|----|------|--|
| 10            |          | 20   |    |      |  |
| 676           | 64       | ö    | 0  | 0    |  |
| 60            | 26       | 57   | 17 | 17   |  |
| 708) 10560(57 | 64)37    | 2    | 42 | 43(0 |  |
| 40356         | 60       |      |    |      |  |
| 204           | )2222(34 |      |    |      |  |
| 60            | 2170     |      |    |      |  |
| )12240(17     | 4        | 6    |    |      |  |
| 12036         | -        | 60   |    |      |  |
| 204           | )28      | 02(4 | 3  |      |  |
| 60            | 27       |      |    |      |  |
| )12240(17     |          | 50   |    |      |  |
| 12036         |          | 60   |    |      |  |
| 204           | )3       | 013( | 17 |      |  |
|               |          | 8008 | =1 |      |  |
|               |          | 35   |    |      |  |
|               |          | 33.  |    |      |  |

The remainder left in the 4th operation of the last article is first reduced to sexagesimal parts, and joined to the remainder left in the 5th operation, of which it makes a part; as the quotient of the 5th operation is however subtractive in the 6th, its remainder including the fractional part, is first subtracted from its divisor 64, and then the difference reduced to sexagesimal fractions of a day. The result shews, that the time of the mean new Moon at the original Meridian, was the 27th March at 34, 43, 47, after noon.

| <b>3</b> 9<br>80)75(0<br>60 |
|-----------------------------|
| )4500( <b>56</b><br>4480    |
| 20<br>60                    |
| )1200(1.                    |

The method here used for finding the allowance to be made for the difference of Meridian, is equivalent to this proportion. As the circumference of the Parallel of Latitude or 4800 yojanas, is to a day or 60°, so is 75 yojanas which we are to the Eastward of the original Meridian, to 56′ 15°.

Difference of Meri-

|      | 40        |           |
|------|-----------|-----------|
| 3.15 | 43'<br>56 | 47°<br>15 |
|      |           |           |
| 35   | 40        | 2         |

1200

The time of mean new Meon is therefore considered to have happened at the place where we now are, at 35° 40° 2° after noon of the 27th March.

Time of new Moon sought,

N. B.—It was often long before I could discover the objects which the following operations: aimed at, and indeed I had gone thro' the whole method and seen to what purposes the computed aumbers were applied, before I could form any conjecture about what was intended.

4. To find the number of mean Zodiacal revolutions of the Moon from the given Epoch to the beginning of the Tellinga year answering to the 23th March.

For the mean Zodiacal revolutions of the Moon from the Epoch,

| 19                           | 20                       | 30                       |
|------------------------------|--------------------------|--------------------------|
| 182263<br>10 ×               | 182 263<br>137           | 182263 -<br>2146         |
| 1822630<br>2300 +            | 182100<br>69 +           | 180117                   |
| 13211)1825130(137<br>1814128 | 85)182169(2146<br>182410 | 27)180116(6670<br>180090 |
| 11002                        | 59                       | 26                       |

The number 182263 is that of the natural days from the Epoch to the beginning of the present year, and when it had been discovered that the number 180116 in the 3d operation was Nacshatras, it was easy to find that the Moon is supposed to describe 556243 Nacshatras in 562870 days exactly. The mean time of the Moon's describing one Nacshatra is therefore 14.0119139 or 14 07 42° 53° 39. As \$4 Nacshatras answer nearly to \$5 days, it follows that if to a small Arc expressed in Nacshatras and sexagesimal parts, be added its \$4th part, we have the time in which that Arc will be described, by the Moon, expressed in days and sexagesimal parts.

Having also discovered that the quotient 6670 in the 3d operation is that of the Zodiacal revolutions, it is easy to see that the Moon is supposed to complete exactly 556243 Zodiacal revolutions in 15197490 days; one Zod'acal revolution of the Moon is therefore equal to 27.32167116 days, that is  $27^{1}$  19° 18° 1° 62, or  $27^{2}$  7° 43′ 12° 65.

For the Moon's mean place in the Zodiac at the beginning of the year. 5. To find the Moon's mean place in the Zodiac at the beginning of the year.

The computations in the last article shewed that the Moon had completed 6670 Revolutions and almost 26 Nacshatras over. The remainders left in those operations, are here reduced to sexagesimal fractions.

| 10<br>11002<br>60  | 59 49 50 34<br>60  |  |  |  |
|--------------------|--------------------|--|--|--|
| 13244)560120(49    | 84)3589(4 <b>2</b> |  |  |  |
| 618956             | 3528               |  |  |  |
| 11164              | 61<br>60           |  |  |  |
| )6698 10750        | )3770(4 <b>4</b>   |  |  |  |
| 662200             | 3696               |  |  |  |
| 7640               | 14                 |  |  |  |
| 60                 | 60                 |  |  |  |
| )458400( <b>31</b> | )871(10            |  |  |  |
| 450296             | 840                |  |  |  |
| 8104               | 34                 |  |  |  |

If the second divisor had been 85, as in the last article, the quotient would have been sexagesimal fractions of a Nacshatra; but by dividing by \$4 instead of 85, and thereby increasing the quotient, one 84th part, it follows from what was before remarked, that instead of the fraction of a Nacshatra, we get the time in which it is described. As this quotient is subtractive, it shows that in 42° 44° 10° the Moon will complete the 26th Nacshatra at the original Meridian, and adding 56° 15°, (3) gives 43° 40° 25° for the time after noon, at the place where we now are, of its completion.

For the number of mean periods of Yogus from the Epoch. 6. To find the number of mean periods of Yogas from the given Epoch to the beginning of the present Tellinga year.

| 10                           | 20                          | 30                               |
|------------------------------|-----------------------------|----------------------------------|
| 182263                       | 18000                       | 182263                           |
| 7 ×                          | 1031                        | 11527                            |
| 1275841<br>618 <b>+</b> *    | 18123 <sup>1</sup> 2<br>2 + | 193590                           |
| 1238)1276459(1031<br>1276378 | 16)181234(11327<br>181232   | 27)193587(71 <b>69</b><br>193563 |
| 81                           | 2                           | 21                               |

The number 193587 in the 3d operation being supposed the Nacshatras which the sum of the mean motions of the Sun and Moon amount to in 182263 days, I find that the sum of the mean motions of the Sun and Moon in 19808 days will be exactly 21039 Nacshatras. The mean time of a Yoga is therefore .9414896 of a day or 56° 29° 21° 75, and 17 mean Yogas nearly equal to 16 days.

In 534816 days there will be 21039 mean revolutions or periods of all the 27 Yogas.

7. To find the mean time when the 25th Yoga will end.

By the last computation it appears that 24 Yogas were completed and the 25th begun.

For the mean time when the 25th Yoga ends.

| 10<br>8 i<br>60            | 20<br>16<br>2   |
|----------------------------|-----------------|
| 1238)4860(3                | 14 3 55 32      |
| 3714                       | 60              |
| 1146                       | 13)343(49       |
| 60                         | 833             |
| )68760(5 <b>5</b>          | 10              |
| 68090                      | 60              |
| 670                        | )655(38         |
| 60                         | 646             |
| )40200(32                  | 9               |
| <sup>2</sup> 3951 <b>6</b> | 60              |
| 684                        | )572(3 <b>3</b> |
|                            | 561             |
|                            |                 |
|                            | 11              |

The quotient \$ 55 \$2 is properly subtractive from 2 the remainder in the second operation in the last article, but the complement of the whole to the former divisor 16 is here taken, because it is not the time since the 24th Yoga ended that is required, but the time until the end of the 25th Yoga. The dividing by 17 instead of 16 gives the second quotient 49° 38° 33° in time, to which adding 59° 15° on account of Meridian distance, we get 50° 34° 48° for the mean time of the end of the 25th Yoga after noon.

8. To find the number of Anomalistic revolutions of the Moon from the Epoch to the beginning of the present Tellinga year.

For the number of Anomalistic revolutions of the Moon from the Epoch.

| 10              | 20                      |
|-----------------|-------------------------|
| 185160          | <b>5</b> 55 <b>4</b> 80 |
| 3 X             | 146                     |
|                 |                         |
| <b>5</b> 55480  | 5556 <b>2</b> 6         |
| 614 +           | 49 +                    |
| 3784)556091(146 | 84)555675(6615          |
| 552464          | 5556 <b>60</b>          |
| 3630            | 15                      |

3630

00

The number 185160 on which this computation is founded, appears to be that of the Tidhis elapsed from the Epoch to the beginning of the year (art. 2, no. 4), and having found out that the quotient 6615 must be that of the Anomalistic revolutions of the Moon, it follows that 105952 Tidhis are equal to 3785 Ano-

malistic revolutions. One Anomalistic revolution of the Moon is therefore equal to 27.9926024 Tidhis, or 27.554600 natural days, that is 27d 33d 16d 33d 62 or 27d 13d 18d 37d 55d.

9. To find the Moon's mean Anomaly, expressed in terms adapted to the Index of the Tidhi Table, for the mean time of new Moon.

The first remainder in the last computation is multiplied by 80, but the

.246 of a guddia. To reduce guddias to the 246th part of a guddia, multiply

For the Moon's mean Anomaly in terms of the Index of the Tidhi Table XXVII.

|                                           | following fractions are sexagesimal parts of it. The quotient thus found     |
|-------------------------------------------|------------------------------------------------------------------------------|
| \$784)290400(7 <b>6</b><br>28758 <b>4</b> | is joined to the second remainder in the last computation, and gives 15      |
| 2816                                      | 76 44 for the Index required.                                                |
| 60                                        | Each unit in the first term of this Index is the 84th part of one Auo-       |
| )168960(44                                | malistic revolution of the Moon, or 328th of a natural day. Each unit of the |
| 166496                                    | second term being one 80th part of the first, is .041 of a natural day, or   |
| 2164                                      | 946 of a guildig. To reduce guilding to the 946th most of a - 11             |

Index of Tables for the Moon's mean Anomaly 15 76 44.

by 4, and to the product add its 60th part. Thus if 15° be given, then  $4 \times 15 \times \frac{4 \times 15}{00} = 61$ , and 61: is to 15:: as 1: to 246 nearly. The reason of this remark will appear hereafter.

For the number of mean—Anomalistic revolutions of the Sun from the Epoch.

10. To find the number of Anomalistic revolutions of the Sun from the Epoch to the beginning of this year.

| 10             | 20                     |
|----------------|------------------------|
| <b>1</b> 85160 | <b>1</b> 85160         |
| 1900 +         | 32                     |
|                |                        |
| 5720)187060(32 | <b>1</b> 8512 <b>8</b> |
| 183040         | 92 +                   |
|                |                        |
| 4020           | 371)185220(499         |
|                | 185129                 |
|                | -                      |
|                | 91                     |

From this computation I find that 5719 Anomalistic revolutions of the Sun are supposed equal to 2122120 Tidhis, so that one Anomalistic revolution must be 371.0043711 Tidhis or 365.2597933 natural days; that is 365<sup>4</sup> 15<sup>5</sup> 31<sup>7</sup> 39<sup>5</sup> 46 or 365<sup>4</sup> 6<sup>5</sup> 12′ 39″ 78″.

For the Sun's mean Anomaly for the mean time of new Moon in terms of the Index,

Index of the Solar Table XL, 90 2 59.

11. To find the Sun's mean Anomaly for the mean time of new Moon expressed in terms adapted to the Index of the Solar Table.

$$\begin{array}{r}
4020 \\
10 \times \\
5720)1020007 \\
40040 \\
\hline
160 \\
60 \\
\hline
)960001 \\
5720 \\
\hline
3880
\end{array}$$

The quotient is subtracted from the second remainder in the last computation, and leaves 90 2 59 for the Index required.

Each unit in the first term of this Index being the 371st part of one Anomalistic revolution of the Sun, or .9845 of a natural day; each unit of the second term will be .09845 of a day or 5.907 guddias. To reduce guddias to the scruples of time expressed by the second term of the Index, divide by 6, and to the quotient add its 60th part. Thus if  $13^{\circ}$  be given, then  $\frac{18}{\circ} \times \frac{18}{\circ \times 60} = 305$ , and 18 is to 3.05 as 5.902 to 1 nearly.

To find the Index to the Nac-hatra Table XXXVIII

12. To find the Index to the Nacshatra Table for the mean time of the Moon's completing the 26th Nacshatra.

| 43°<br>35 | 10<br>40°<br>40 | 25°<br>2   | 15      |          | 44<br>34     |    | 16 | 30<br>29<br>62 | 18<br>20 |
|-----------|-----------------|------------|---------|----------|--------------|----|----|----------------|----------|
| 8         | 0               | 23<br>-‡ × |         | 29<br>29 | 1S(0 62<br>0 | 20 | 15 | 46             | 58       |
| 32        | 1<br>32         | 32<br>1    | <u></u> |          | 18           |    |    |                |          |
| 32        | 33              | 33         |         |          |              |    |    |                |          |

From the time of the Moon's completing the 26th Nacshatra (5) subtract the mean time of new Moon (3) which shews the former to be

SE OV 23P later than the latter. Multiply this difference by 4 and to the product add its 60th part (9), which gives 32 31 nearly for the increase answering to that time.

To the Index of the Tidhi Table for the mean time of new Moon (9), add the increase thus found, and it gives the Index of the Tidhi Table for the time of the Moon's completing the 26th Nacshatra 16 29 18.

The Index of the Tidhi Table being expressed in \$4th parts of the circumference of a Circle, and the Index to the Nacshatra Table being expressed in 80th parts of the same, the Index of the

former must be diminished four 84th parts, or one 21st part, in order to adapt it to the latter Table.

This correction being made, gives 15 46 53 for the Index to the Nacshatra Table at the given time.

Index to the Nacshatra Table 15 46 58.

13. To find the Index to the Yoga Table for the mean time of the end of the 25th Yoga, or for 50g 34v 48p after noon (7).

To find the Index of the Yoga Table XXXIX 17 9 13.

|                  | 10               |                |   |             | 2                        | 0        |    |     |    | 30       |          |
|------------------|------------------|----------------|---|-------------|--------------------------|----------|----|-----|----|----------|----------|
| 50<br><b>3</b> 5 | 3 <b>1</b><br>40 | 48<br>2        |   | 15          |                          | 44<br>39 |    |     | 16 | 57<br>31 | 23<br>50 |
| 14               | 54               |                | × | 42)16<br>16 | 5 <b>7</b><br>5 <b>7</b> |          | 31 | 50` | 17 | 9        | 13       |
| <b>5</b> 9       | 39<br>59         | <b>4</b><br>39 |   |             |                          | 23       |    |     |    |          |          |
| 60               | 38               | 43             |   |             |                          |          |    |     |    |          |          |

This computation is the same in principle with the last, onlythat as the Index to the Tidhi Table is expressed in 84th. parts of the circumference, and the Index to the Yoga

Table in 86th parts of the same, the Index of the former must be augmented two 84th parts, or one 42d part, in order to adapt it to the latter Table.

14. The four Tables made use of in this method, are next to be considered.

The XXXVII th, or Tidhi Table, answers to an Anomalistic revolution of the Moon, and as Table XXXVII its Index increases to 84, each unit thereof is nearly one third of a Tidhi, there being 27.9926 Tidhis in an Anomalistic revolution (8). For each Tidhi, therefore, the Index to this Table must be increased 3 0 4. The first column after the Index seems to be that of the Moon's Equation converted into time by the following proportion, viz. as the Moon's true diurnal motion minus the Sun's mean diurnal motion, is to the Moon's Equation expressed in degrees, &c. so is 60s or a natural day to the Equation inserted in the Table. The last column seems to be that of the true diurnal motion of the Moon minus the mean diurnal motion of the Sun expressed in degrees, &c.

The XXXVIII, or Nacshatra Table, answers also to an Anomalistic revolution of the Moon, Table XXXVIII and as its Index increases to 80, each unit thereof, is nearly one third of the time in which the Moon describes a Nacshatra. Hence, as an Anomalistic revolution or 27d 55 44 (8), is to 80, so is the time of describing a Nacshatra or 1a.01191 (4) to 2.9379 or 2 75 2, the increase of the Index of this Table answering to one mean Nacshatra. The other column seems to be that of the Moon's Equation converted into time by this proportion, viz. as the Moon's true diurnal motion, is to her Equation expressed in degrees, so is 60s, to the Equation inserted in this column.

The XXXIX or Yoga Table, answers still to an Anomalistic revolution of the Moon, and as its Table XXXIX Index increases to 86, each unit thereof answers to one third nearly of the time of a mean Yoga. Hence 27a 55 46, is to 86, as the time of a Yoga, or .94149 (6), to 2.9385 or 2 75 4, the increase of the Index for one Yoga. The first column after the Index seems to be that of the Moon's Equation

converted into time, by the following proportion, viz. as the Moon's true diurnal motion plus the mean diurnal motion of the Sun, is to the Moon's Equation expressed in degrees, &c., so is 60g to the Equation inserted. The last column appears to be that of the true diurnal motion of the Moon plus the mean diurnal motion of the Sun.

Table XI.

The XI. st, or Solar Table, answers to an Anomalistic revolution of the Sun, and as it increases to 371, each unit thereof answers nearly to one Tidhi. The first column after the Index seems to be that of the Sun's Equation expressed in degrees, &c. (in the original it was expressed in seconds), but by the manner in which it is used, the Sun's Anomaly seems to be reckoned from the Perigee and not the Apogee. The last column is that of the semi-diurnal Arcs expressed in time.

For the true time of new Moon.

- 15. To find the true time of new Moon, or of the beginning of the first Tidhi Padyami.
- (15 76 44) Refer to the Tidhi Table with the Index before found (9), and take out the corres-23g 49v 11' 55 ponding numbers, with the proportional parts.
- 6)23z 49v(3 58

  The Lunar Equation being additive, the Index to the Solar Table before found

  1 4 2

  The Lunar Equation being additive, the Index to the Solar Table before found

  (11) requires an augmentation proportioned thereto. Divide therefore the Lunar

  Equation by 6, and to the quotient add its 60th part, which gives the correction to be added to the Index to the Solar Table before found.
- (90 7 1) With the Index thus corrected, refer to the Solar Table, and take out the corres-14g 4 iv ponding numbers from both columns.
- 710)7823(11 Divide the Sun's Equation expressed in seconds, by the number taken out of the 7810 last column of the Tidhi Table expressed in minutes, (they are so inserted in the 60 original Tables) and the quotient is guddias and viguddias of time. In other words, say, as the Moon's diarnal motion from the Sun, is to 60g, so is the Arc expressed by the Sun's Equation, to the time in which it will be described.

To the mean time of new Moon (3), add the Lunar Equation, and also the Solar Equation reduced to time, and the sum shews the true time of new Moon to fall on the 28th March at 10g 30v after noon, and by adding the semi-diurnal Arc, that it fell on the 28th March at 2ig 14v after Sun rise.

For the true time of the end of the 26th Nacshatra,

- 16. To find the true time of the end of the 26th Nacshatra, or the beginning of the 27th named Revati.
- (15 46 58) Refer to the Nacshatra Table with the Index before found (12), and take out 225 8 the corresponding Equation.

| 0 | 43 | 49 |
|---|----|----|
| 0 | 22 | 9  |
| 1 | 5  | 49 |
| 0 | 14 | 41 |
| 1 | 20 | 33 |

To the mean time add this Equation, and also the semi-diurnal Arc, which shews that the 27th Nacshatra began on the 28th March at 53 49v after noon, or at 205 33v after Sun rise.

17. To find the true time of the end of the 25th Yogz, or beginning of the 26th named Indra.

17. To find the true time of the end of the 25th Yogz, or beginning of the 26th named Indra.

18. Refer to the Yoga Table with the Index before found (13), and take out the 25th Yogz, or beginning of the 26th named Indra.

19. 13
205 47v
13 55' corresponding number including the proportional parts.

For the true time of the end of the 25th Yoga,

| 5.)₹ | 344 | 43P  |    |
|------|-----|------|----|
| 35   | 40  | 2    |    |
| 14   | 54  | 46   |    |
| 20   | 47  | 0    |    |
| 6)35 | 41  | 46(5 | 57 |
| 35   | 42  | 0    | 5  |
|      |     | 6    | 2  |
| 90   |     | 9    |    |
|      | 6   | $^2$ |    |

1

The Index to the Solar Table is here not only to be augmented on account of the Lunar Equation, but also on account of the difference between the mean time of new Moon (3) and the mean time of the Yega, or for 35g 42v in all; and the correction found by article 11 is to be added in the present instance, to the Index to the Solar Table before found.

)90 9 1( 2' 10' 25"

90

Refer to the Solar Table with the Index thus corrected, and takeout the corresponding Equation.

Divide the Sun's Equation expressed in seconds, by the last number taken out of the Yoga Table expressed in minutes, as in article 15th; or say, as the sum of the diarnal motions of the Sun and Moon, is to 60s, so is the Sun's Equation to the time corresponding.

> 30 2

60

7)59(8

56

3

1

To the mean time of the Yoga (7), add the Lunar Equation, and from the sum subtract the time answering to the Solar Equation. Add also the semi-diurnal Arc, and the result shows that the 26th Yoga began on the 28th March at 15 50v after noon, or at 16g 43v after Sun rise.

13. To find the Carna for the beginning of the year.

Thirty Tidhis having elapsed since the preceding new Moon, multiply this number by 2, because a Carna is half a Tidhi; and subtract one from the product, because the first Carna begins in the middle of the first Tidhi. As 59 Carnas have passed since the series began, divide this number by 7, and the quotient 8 shews that so many complete series of the seven ordinary Carnas have passed, and the remainder, that three of the four extraordinary Carnas are also past. The last of the eleven Carnas, or

For the Carna in the beginning of the year.

the fourth extraordinary Carna begins with the first Tidhi, or at 21° 14° after Sun rise on the 28th March, as already found (15).

For the mean time of the beginning of the 2d Tidhi.

19. To find the mean time of the beginning of the 2d Tidhi, 23th Nacshatra and 27th Yoga; or end of the 1st Tidhi, 27th Nacshatra and 26th Yoga.

|    | Tid | hi, |    |    | Nac | shatra |    |    | Y   | oga. |    |
|----|-----|-----|----|----|-----|--------|----|----|-----|------|----|
| D. | G.  | V.  | P. | D. | G.  | v.     | P. | D. | G.  | v,   | P. |
| 0  | 35  | 40  | 2  | 0  | 43  | 40     | 25 | 0  | 5() | 34   | 48 |
| 0  | 59  | 3   | 40 | 1  | 0   | 42     | 53 | 0  | 56  | 29   | 22 |
|    |     |     |    |    |     |        |    |    |     |      |    |
| 1  | 34  | 43  | 42 | 1  | 44  | 23     | 18 | 1  | 47  | 4    | 10 |

This is simply to add the mean time of one Tidhi, one Nacshatra and one Yoga (2, 4 and 6) to the mean time of the beginning of the last Tidhi, Nacshatra and Yoga (3, 5 and 7).

For the Indices of the Tidhi, Solar, Nacshatra and Yoga Tables. 20. To find the Indices of the Tidhi, Solar, Nacshatra and Yoga Tables, for the time of the beginning of the 2d Tidhi, 28th Nacshatra and 27th Yoga.

|    | Tidhi |    | Na | .cahatr    | a. |    | Yoga,     | į  | 5             | Solar. |    |
|----|-------|----|----|------------|----|----|-----------|----|---------------|--------|----|
| 15 | 76    | 44 | 15 | 46         | 58 |    | 9         |    | 90            | 2      | 59 |
| 3  | 0     | 4  | 2  | <b>7</b> 5 | 2  | 2  | <b>75</b> | 4  | 1             | 0      | 0  |
|    |       |    |    |            |    |    |           |    | <del></del> - |        |    |
| 18 | 76    | 48 | 18 | 42         | 0  | 20 | 4         | 17 | 91            | 2      | 59 |

To the Indices before found (9, 11, 12 and 13) add the increase of each respectively, for one Tidhi, one Nacshatra, and one Yoga (11).

For the true time of the beginning of the 2d Tidhi. 21. To find the true time of the beginning of the 2d Tidhi.

| 19              | 20                                  | 40         | 50                                   |              | 60             |                |
|-----------------|-------------------------------------|------------|--------------------------------------|--------------|----------------|----------------|
| (18 76 48)      | 6)24 47 <sub>1</sub> 4 8<br>24 48 4 | (91 7 11)  | <b>72</b> 5)7827″(10<br><b>7</b> 250 | р.<br>О<br>О | 6.<br>34<br>24 | v.<br>43<br>47 |
| 6, V.           | 4 12                                | 2° 10′ 27° | 577                                  | 0            | 10             | 48             |
| 24 47<br>12° 5′ | 30<br>91 2 59                       | 14 41      | 60<br>                               | 0            | 10<br>14       | 18<br>44       |
|                 | $4 12$ $\overline{91 7 11}$         |            | 34830                                | 1            | 25             | 2              |

The 2d Tidhi begins therefore on the 29th March or 1st day of the Tellinga year, at 10g 18v after noon or 25g 2v after Sun rise.

For the true time when the 28th Nacshatra begins. 22. To find the true time when the 28th Nacshatra begins.

It begins therefore on the 29th March at 7g 22v after noon or 22s 6v after Sun rise.

23. To find the true time when the 27th Yoga begins.

| 10             | 20                           | 30              | 50                  | D. | G.       | v.       |
|----------------|------------------------------|-----------------|---------------------|----|----------|----------|
| (20 4 17)      | 47 4 10<br>34 43 42          | 91 2 59<br>5 42 | 850)7827"(9<br>7650 | 0  | 47<br>21 | 4<br>22  |
| 6. v.<br>21 22 | 12 20 28<br>21 22 0          | 91 8 41         | 177<br>60           | 0  | 8<br>9   | 26<br>12 |
| 14° 10′        | 6)33 42 28(5 37<br>33 42 0 5 | 91 8 41         | )10620(12<br>10200  | 0  | 59<br>14 | 14<br>44 |
|                | 28 5 42                      | 2 10 27         | 420                 | 1  | 13       | 58       |

For the true time when the 27th Yoga begins.

The 27th Yoga begins therefore, on the 29th March at 13: 58' after Sun rise.

24. To find the Carna.

A Carna being half a Tidhi, the computation of the former differs in nothing from the computation of the latter; only that instead of advancing by a mean Tidhi at a time, as in art. 19, no. 1, we must only advance by half a mean Tidhi at a time.

For the Carna.

In the present instance, it need only be observed that the 2d Carna begins with the 2d Tidhi.

25. To find the Wurjum next after the new Moon.

|             | 1 <sup>d</sup><br>0 | 10<br>22*<br>20 | 6 <b>°</b><br>33 | 30°<br>20 | 46*<br>33 |
|-------------|---------------------|-----------------|------------------|-----------|-----------|
| ,           | 1                   | 1               | 33<br>30         | 51<br>29  | 19<br>28  |
| <b>6</b> 0) | )30<br><b>30</b>    | 46<br>46        | 30,30 46<br>0    | 21        | 51        |

From the time when the 28th Nacshatra begins (22), subtract the time when the 27th begins (16), and the difference 1<sup>4</sup> 1<sup>5</sup> 33<sup>7</sup> is the time in which the Moon describes the 27th Nacshatra: then say, as 1<sup>4</sup> or 60<sup>5</sup>, is to the time of the Moon's describing it, so is 30<sup>5</sup> the Druva of the 27th Nacshatra to the time of the Moon's describing that Arc, viz. 30<sup>5</sup> 46<sup>7</sup>.

To the time thus found, add the time of the Moon's entering the 27th Nacshatra; which shows that the Wurjum began 51° 19° after Sun rise, and subtracting double the semi-diurnal Arc, that it began 21° 51° after Sun set.

The Thyajum or continuance of the Wurjum, is reckoned to be 45 of time.

The Thyajum 4 gud. dias of time.



## PART II.

Method of computing the mean and true places of the Planets in the Zodiac, by means of Astronomical Tables.

1. No Tables are made use of in the Surriah Siddhanta, but modern Astronomers often make use of Tables, and as I have been told that *Vavilala Cuchinna*'s Tables agree very well with the Rules given in the Surriah Siddhanta, I shall insert them here, according to the copy which I obtained.

Epoch of Vavilala Cachinna's Rules and Tables. It has already been observed, that those who use these Tables commence their computations from noon of the last day of the 4399th year of the Cali yug, for which Epoch, Vavilala has given the Druvas or mean places of the Planets, and their higher Apsides.(\*) I have no doubt that he gave the places of the ascending Nodes for the same time, but as I did not obtain this information from my Instructor, I endeavoured to supply it otherwise. Indeed the person from whom I procured a copy, did not know the use of the last column of the Tables for the Annual Equations of the Planets, which I found to be the Chila Carna, and necessary, (according to the method taught in the Surriah Siddhanta,) for finding the Latitudes of the Planets.

2. Druvas or mean places of the Planets, their Apsides, and Nodes, for noon of the last day of the 4339th year of the Cali yug.

Mean place of the Planets on the last day of the 4399th year of the Cali yag, called their Druva,

| Pla             | inets. |   |       | Mo  | an pl | ace, |    |   | - 1 | psis.      |    |   | 7  | Tode. | •  |
|-----------------|--------|---|-------|-----|-------|------|----|---|-----|------------|----|---|----|-------|----|
|                 |        |   | S     | ۰   | ٠     | ,    | ,  | • | o   | - /        | // | 3 | ۰  | 1     |    |
| Sun             | -      | • | 11    | 15  | 26    | 34   | 23 | 2 | 17  | 16         | 19 |   |    |       |    |
| Moon (†)        | -      | - | 11    | 5   | 48    | 37   | 29 | 4 | 15  | 26         | 17 | 0 | 6  | 12    | 9  |
| Mais            | -      | - | 9     | 22  | 35    | 27   | 41 | 4 | 10  | 2          | 5  | 1 | 10 |       | 42 |
| Mercury         | -      | _ | 10    | 26  | 43    | 8    | 46 | 7 | 10  | 2 <b>7</b> | 18 | 0 | 20 | 42    | 4  |
| <b>J</b> upiter | -      | - | 10    | 15  | 45    | 15   | 40 | 5 | 21  | 19         | 48 |   | 19 | 40    | 35 |
| Venus           | -      | - | 8     | 22  | 20    | 19   | 15 | 2 | 19  | 50         | 46 | 1 |    | 41    | 56 |
| Saturn          | _      | - | 2     | 28  | 53    | 31   | 36 | 7 | 26  | 37         | 27 | 3 | 10 |       | 39 |
| froi            |        |   | . 1 . | . 1 | 221   |      |    |   |     |            | _  |   |    |       |    |

Motion of the Apsides.

The motion of the Apsides of the Planets was stated to me as follows: Sun's Apogee 1' in 517 years. Mars' Apsis 1' in 980 years. Mercury's do. 1' in 544 years. Jupiter's do. 1' in 222 years. Venus' do. 1' in 374 years. Saturn's do. 1' in 5123 years.

<sup>(\*)</sup> Vide Appendix at the end of the Note.

<sup>(+)</sup> The Moon's Apogee and Node are subject to a Bijah or correction of 4 revolutions in a Maha yug, as was shewn in the Second Memoir, Part II; but the Tellinga Astronomers do not seem to make use of it. This Bijah, with its Druva, will be found in Table XXII.

The motion of the Nodes, according to the rules given in the Surriah Siddhanta, may be stated as follows: Mars' Node 1' in 935 years. Mercury's do. 1' in 410 years. Jupiter's do. 1' in 1149 years. Venus' do. 1' in 222 years. Saturn's do. 1' in 302 years. It is to be remembered, that all the Nodes are supposed to have a retrograde motion.

Motion of the Nodes.

In finding the Ayanansa, or distance between the vernal Equinoctial point and beginning of Mesha  $\gamma$ , at a particular time; it is only to be remembered, that these points are supposed to have been coincident at the expiration of the 3600th year of the Cali yug, and that the Equinoctial points have a retrograde motion at the rate of 54° in one Sydereal year. To find the Ayanansa, therefore, for the end of the 4899th year of the Cali yug, we have 4899 - 3600 = 1299, and  $1290 \times 54$ ° =  $19^{\circ}$  29° 6°, which is but little different from the Ayanansa for the same period found by the former method.

The Ayanansa,

3. A. To find the mean place of the Sun, for the mean time of midnight, at the beginning of the 4900th year of the Cali yug, under the meridian of Lanca. From the expired years 4890 of the Cali yug, subtract 4399 years 63), and find the number of days contained in the 4399 difference, which is 182618 (\*). Then the Sun's mean motion for this number of days, will be found by the Table, as follows:

The Sun, Table XX, mean Elements.

```
100000
             9
                10
                      15
                          56
             0
                  8
                     12
                          44
 80000
                21
                                    The Sun's mean motion in 182618 days, is therefore found
  2000
             5
                      12
                          19
             7
                 21
                     21
   600
                          42
                                  to be 11' 18' 47' 8".
    10
             0
                  9
                      51
                          22
      3
                  7
             0
                      53
                            5
182613
            11
                 18
                     47
                            8
```

Sun's mean motion from Epoch, Index to Solar Table.

To the Sun's mean motion for 182518 days, add the Druva (2) and this gives his mean place at noon of the last day of the 4899th year of the Call yug, to which adding half the Sun's diurnal motion, we get his mean place for midnight, or the beginning of the 4900th year of the Cali yug. 

Sun's mean place at Lanca for mean midnight at Lanca.

B. To find the place of the Sun's Apogee for the beginning of the 4900th year of the Cali yug.

As the Sun's Apogee moves at the rate of 1' in 517 years (3), we have  $\frac{1' \times 500}{517} = 58''$  for its motion in 500 years.

<sup>(\*)</sup> The manner of finding the Index to Vavilain Cuchinna's Tables was given at Part III, Article 2 of the 2d Memoir. In the present case it will be

I.  $\frac{66389 \times 500 + 85211}{1860000}$  . 184 Adigah mosths, and 19  $\times$  560 + 184 = 6184.

II.  $\frac{6270563 \times 6184 - 3875864}{13338334}$  - 2002 Cshaya Tidhis, and 30  $\times$  6184 - 2902 = 182618 Bhumi savan days, the

Place of the Sun's Apegee.

17 17 17

To the Druva or place of the Sun's Apogee at the Epoch, add the motion of his Apogee in 500 years, and this gives the place of his Apogee at the time required.

apparent True or Llements

C. Given the Sun's mean place 11' 4' 43', and the place of his Apogee 2' 17' 17'; to find his true place.

Table XXII.

17 17 4 43 12 34

1º With the Argument 3' 12' 34' refer to the Sun's Anomalistic Table (5) and take out the corresponding Equation + 2 7.

Sm's true place for mean midnight.

4

To the Sun's mean place for the mean time of midnight, apply the Equation with its proper Sign, and it gives his true place for the mean time of midnight...

Sun's true place and true midnight Area Bhagabala.

2º For the Arca Bhagábala, take the 365th part of his Equation  $+\frac{2^{\circ}}{565} = 20^{\circ}$ , which being less than 1', is here neglected.

Sun's mean diurnal

D. Given the Sun's mean diurnal motion 59' 8"; to find his true diurnal motion.

motion 59' 8". Table XXII.

The Tabular increase of the Sun's Equation for 3' 45' answering to the Argument 3' 12° 34' is 1' 53", hence  $\frac{1'-53\times59'}{3"+59'} = 30"$  is the Equation sought.

The Sun being nearer his Perigee than his Apogee, the Equation is additive.

The Moon, Table XXI, mean Elements.

4. A. To find the mean place of the Moon, as also of her Apogee and Node, for the beginning of the 4900th year of the Cali yug, and Meridian of Lanca.

First find the motion of each respectively for 182618 days, and then add the Druvas (6 3).

| Days.             |      | Mo         | en. |     |     | Apeg | ce (*) |     |    | N   | ode. |     |
|-------------------|------|------------|-----|-----|-----|------|--------|-----|----|-----|------|-----|
| 100000            | 1'   | 5°         | 12' | 53" | 11* | 8°   | 17'    | 27" | 81 | 18° | 28'  | 52" |
| 80000             | 0    | 28         | 10  | 18  | 9   | 0    | 37     | 53  | 9  | 8   | 47   | 6   |
| 2:000             | 2    | 12         | 42  | 15  | 7   | 12   | 45     | 57  | 3  | 15  | 58   | 11  |
| 600               | 11   | 15         | 48  | 41  | 2   | 6    | 49     | 47  | 1  | 1   | 47   | 27  |
| 10                | 4    | 11         | 45  | 49  | 0   | 1    | 6      | 50  | 0  | 0   | 31   | 48  |
| 8                 | 3    | 15         | 21  | 39  | 0   | 0    | 53     | 28  | 0  | 0   | 25   | 26  |
| 182618            | 11   | <b>2</b> 9 | 4   | 35  | 6   | 0    | 31     | 27  | 10 | 15  | 58   | 50  |
| Druva             | 11   | 5          | 48  | 37  | 4   | 15   | 26     | 17  | 0  | 6   | 12   | و   |
| Place at Noon .   | 11   | 4          | 53  | 12  | 10  | 15   | 57     | 44  | 1  | 20  | 13   | 19  |
| ½ Diurnal motion  | -    | 6-         | 35  | 17  |     |      | 3      | 20  |    |     | 1    | 35  |
| Tlace at midnight | - 11 | 11         | 28  | 29  | 10  | 16   | 1      | 4   | 1  | 20  | 11   | 44  |

Index.

Moon's mean place.

B. Given the Moon's mean place, and the place of her Apogee; to find her true place.

<sup>(\*)</sup> The Bijah of 4 revolutions in a Maha yug, additive, is here omitted, as already noticed,

10 To the Moon's mean place for the mean time of midnight, add the

27th part of the Sun's Equation  $\frac{2^{\circ} 7'}{27} = +5'$ , for the Arca Bhagábala; Arca Bhagábala.

and it gives the Moon's mean place for the apparent time of midnight.

20 With the Argument 11' 4° 25', refer to the Lunar Table, and take Table XXIII.

10 10 1 20 With the Argument 11 4 23, refer to the Lunar Table, and take Table XXIII.

11 11 33

out the corresponding Equation 2° 11'.

From the Moon's mean place corrected, subtract the Equation thus found, True or apparent

11 11 33 From the Moon's mean place corrected, subtract the Equation thus found, Elements.

| True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elements. | True or Elem

Moon's true place.

C. Given the Moon's mean diarnal motion 13° 10' 35", and her diarnal motion from her Apogee; to find her true diarnal motion.

The increase of the Moon's Equation for 3° 45' answering to the Argument 11' 4° 28', is Table XXIII. 18' 4"; and  $\frac{13^{\circ} 3' 54'' \times 18' 4''}{3^{\circ} 45'} = 1^{\circ} 2' 56''$ , the Equation sought.

13° 10′ 35" This Equation, in the present instance is to be subtracted from the mean 1 2 56 motion.

D. To find the Moon's Latitude for the time given.

From the Moon's true place, subtract that of her Node, to get the Argu.

Moon's Latitude.

1 20 12

9 19 10

ment; the Sine of which is 3247', and the Sine of 4° 30' the inclination of

the Moon's Orbit, is 270', so that  $\frac{270' \times 3247}{3438} = 252'$  is the Sine of the Moon's Latitude and

4° 12' the Latitude sought, which is South in the present example.

### THE PLANETS.

To find the mean place of Mars for the beginning of the 4900th year of the Cali yug. Mars, Table XLI . 000001 21° 56 16" To Mars' mean motion for 182618 days add the Druva 80000 5 11 33 Ahargana from the 1 Epoch or Index. 2000 10 28 2 19 (63) 9 22° 35' 23", and half his mean diurnal motion (68) 10 14 42 600 24

10 - 0 5 14 25 0° 15' 43", which gives 7' 18' 13' 26" for his mean place at

182618 - 9 25 22 15 midnight, at the time given.

Mars' mean place at midnight at Lauca,

B. To find the place of Mars' Apsis and Node for the same time.

Since Mars' Apsis moves at the rate of 1' in 980 years (3), we have  $\frac{1' \times 500}{900} = 30'$  for its His Aphelion. motion in 500 years, and this added to the Druva (6 3), gives 4' 2' 10' 35" for its place at the time given.

And since Mars' Node moves at the rate of 1' in 935 years (3), we have  $\frac{1 \times 590}{500} = 32^{\circ}$  for His Node.

its motion in 500 years, which subtracted (because the Nodes move retrograde) from the Druva (3), gives 1° 10° 5′ 10° for its place at the beginning of the 4000th year of the Cali yag.

For Mars' true place,

C. Given Mars' mean place, the place of his Apsis, and the Sun's mean place; to find the true place.

Arca Bhagábala,

d place once cor-

10 To the Sun's mean place apply the 365th part of his Equation before found, and to Mars' mean place apply the 687th part of the Sun's Equation for the Arca Bhagábala; but as these corrections are each of them less than 1', they are omitted.

| receu,              | s  | •  | ,  |                                                                               |
|---------------------|----|----|----|-------------------------------------------------------------------------------|
|                     | 11 | 4  | 43 |                                                                               |
|                     | 7  | 18 | 13 | 2º From the Sun's mean place, subtract that of Mars, both corrected as above, |
|                     | 3  |    | 30 | and with this Argument take out the Equation + 37° 8' from Mars' Annual       |
| Table XLI , part 3. | 7  | 18 | 13 | Table, and apply one half of this to his mean place once corrected, to get it |
| Twice corrected,    | +  | 18 | 34 | twice corrected.                                                              |
|                     | 8  | 6  | 47 |                                                                               |

4' 10° 3' 8 6 47 8 3 16

3º From the place of Mars' Apsis, subtract his place twice corrected, and with this Argument take out the Equation 10 20, and apply the half of this to his place twice corrected, to get his mean place thrice corrected.

Thrice corrected. 8 6 47
5 10

8 1 37

4° 10° 3′ 8 1 37

18

10

7

13

 $4\tilde{o}$ 

28

Table XLI, part 2. 8 8 26

7

3521

3438

83

d true Heliocen-

4º From the place of Mars' Apsis, subtract his place thrice corrected, and with this Argument take out the Equation 10° 45' from the Anomalistic Table, which apply to Mars' place once corrected, in order to get his true Heliocentric place.

|   | 11 <b>°</b><br>7 | 4°<br>7 | <b>43'</b><br>23 | 50 From the Sun's mean place corrected by the Arca Bhagábala, subtract |
|---|------------------|---------|------------------|------------------------------------------------------------------------|
|   | 3                | 27      | 15               | Mars' Heliocentric place, and with this Argument take out the Equation |
|   | 7                | 7       | 28               | + 1° 9° 10' from the Annual Table, which apply to Mars' Heliocentric   |
| + | 1                | 9       | 10               | place, in order to get his true Geocentric place.                      |
|   | 8                | 16      | 38               | place, in order to get his true Geocement place.                       |

Part 3.

d true Geocentric place.

D. Given Mars' mean, to find his true diurnal motion.

For his true diarnal motion.

1º From the Chila carna answering to the Argument 3º 16° 30', subtract the Radius. From the Sun's mean diurnal motion, subtract that of Mars.

Table XLI ., part 3.

| 58 8 $\frac{31}{26}$ Then half the Equation $\frac{27'}{3521} \times 89'$ is to be added to, or subtracted from $\frac{27'}{42} \times 42'$                                |                                      |
|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------|
| Mars' mean diurnal motion, according as the Chila carna is greater or less than the  Radius, in order to get his diurnal motion once corrected.                            | Once corrected,                      |
| 31' 46" 29 The increase of the Anomalistic Equation for 3° 45' when the Argument is                                                                                        |                                      |
| 33 15 8s 3' 16' is 21'; and half the Equation $\frac{31'45'' \times 21'}{3''} = 2''$ 58' being added to the                                                                | Part 2.                              |
| diurnal motion once corrected, gives it twice corrected.                                                                                                                   | Twice corrected.                     |
| 31' 26" 30 The increase of Mars' Anomalistic Equation for 3° 45' when the Argument                                                                                         |                                      |
| $\frac{+2}{33}$ $\frac{21}{47}$ is 8° 8° 26', is 16; and the Equation $\frac{33'15'' \times 16'}{3} = 2'$ 21" being applied to                                             | Part 2.                              |
| Mars' mean diurnal motion, gives his diurnal motion thrice corrected.                                                                                                      | Thrice corrected.                    |
| 84387                                                                                                                                                                      | Part 3.                              |
| 3124  4º Take the difference between the Radius and Chila carna answering to 3s 27° 15'.                                                                                   |                                      |
| 50 8' S3 47 From the Sun's mean diurnal motion, subtract that of Mars thrice corrected.                                                                                    |                                      |
| 25 21  33 47 Then is the Equation $\frac{25 \cdot 21' \times 314'}{3124} = 2' \cdot 33''$ to be applied to Mars' diurnal                                                   |                                      |
| 2 33 31 14 motion thrive corrected, to get his true diurnal motion.                                                                                                        | True diurnal mo-                     |
| E. To find Mars' Latitude from the foregoing data.                                                                                                                         | For & Latitude,                      |
| 13 10° 3' To the mean place of Mars' Node (B), add the annual Equation (C, no. 5), 1 9 10                                                                                  |                                      |
| which gives its corrected place.                                                                                                                                           | Part 2.<br>Node corrected,           |
| 8' 16° 38' From Mars' true place (C, no. 5), subtract the corrected place of his Node, 2 19 13                                                                             |                                      |
| 5 27 25 and the Sine of the difference is 15 5', Mars' greatest apparent Latitude being                                                                                    | Table XXX.                           |
| 1° 30′, its Sine is 90′, and the Chila carna is 312 !′ (D, no. 4). Hence $\frac{90 \times 155'}{5124} = 4'$ is the Latitude sought, which in the present example is North. | d' true Latitude,                    |
| A. To find the mean place of Mercury for the beginning of the 4900th year of the Cali yug.                                                                                 | Mercury, Table                       |
| 100000 - 9° 1° 48′ 16" To Mercury's mean motion for 182618 days, add the Druva                                                                                             | XLII.                                |
| 80000 - 4 25 26 37<br>2000 - 8 24 38 10 (6 3) 10° 26° 48′ 9″ and half his mean diurnal motion 2° 2′ 46″,<br>600 - 9 25 23 27                                               | His mean place at midnight at Lanca, |
| 10 - 1 10 55 £3 which gives 9' 29° 47′ 7″ for his mean place at midnight at the 8 - 1 2 44 19                                                                              |                                      |
| 182618 - 11 0 56 12 time given,                                                                                                                                            |                                      |

For his Aphelion and Node.

To find the place of Mercury's Apsis and Node for the same period.

Since Mercury's Apsis moves 1' in 544 years, we have (6 3)  $\frac{1' \times 500}{511} = 55''$  for its motion in 500 years, and this added to the Druva, gives 7s 10° 28' 12" for its place at the given period, and since his Node moves 1' in 410 years  $\frac{1' \times 500}{410} = 1' \cdot 13''$  is its motion in 500 years; and this subtracted from the Druva, gives 0, 20° 40′ 51" for its place at the time required.

For &'s true place,

- Given Mercury's mean place, the place of his Apsis, and the Sun's mean place; to find Mercury's true place.
- 10 Find the Arca Bhagábala for the Sun as before, and to Mercury's mean place add the 88th part of the Sun's Equation  $+\frac{2^{\circ}7'}{58}=1'$ , which gives 9s 29° 48' for his mean place once Sun's mean place once corrected. corrected.

XLII, Part 3.

Twice corrected,

| 10 | 25     | 5               |
|----|--------|-----------------|
| 11 | 4<br>4 | <b>43</b><br>36 |
|    |        |                 |

48'

43

28

Q۶ 29°

11

- 11 0 7
- 10 28 7 11 7 10 8 21
- 7 11 0 Part 2. 2 7 Thrice corrected. 10 28 0

7 10

> 0 27

XLII, Part 3.

Sun's place four

times corrected,

29 21 11 0 27 B's true Geocentric 10

11

10

- 2c From Mercury's mean place, subtract that of the Sun, both once corrected, and with this Argument take out the Equation 9° 11' from the Annual Table, one half of which applied to the Sun's place once corrected, gives it twice corrected.
- 3º From the place of Mercury's Apsis subtract the Sun's place twice corrected, and with this Argument take the Equation 4º 14' from the Anomalistic Table, one half of which applied to the Sun's place twice corrected, gives it thrice corrected.
- 40 From the place of Mercury's Apsis, subtract the Sun's place thrice corrected, and with this Argument take the Equation 4° 16' from the Anomalistic Table, and this applied to the Sun's place once corrected, gives the fourth correction of the Sun's place.
- 50 From Mercury's place once corrected, subtract the Sun's place four times corrected, and with this Argument take the Equation 8° 6' from the Annual Table, and this applied to the Sun's place four times corrected, gives Mercury's true Geocentric place.

His diurnal metion.

place.

D. Given Mercury's mean, to find his true diurnal motion.

```
4533
             19 From the Chila carna answering to the Argument 10' 25' 5', subtract the
                                                                                                        Part 3.
5438
           Radius.
1095
            32
       5
 4
      59
             8
                        From Mercury's mean diarnal motion, subtract that of the Sun.
 3
       Ô
            21
 0
      59
             S
                        Then half the Equation \frac{3^{\circ} 6^{\circ} 94'' \times 1095'}{2573} = 45' 2'' is to be applied to the
   4- 22
            31
      21
           39
                     Sun's mean diurnal motion, in order to get the diurnal motion once corrected.
                                                                                                        Once corrected.
          39*
    21'
                      29 The increase of Mercury's Anomalistic Equation, when the Argu-
            6
                   ment is 3' 10' 21', being 6', for one Pinda or 3' 45', half the Equation
     22
          45
                   \frac{1^{\circ} \le 1' \cdot 39^{\circ} \times 6'}{3 \cdot 45} = 2 11 is applied to the mean motion once corrected, to get it
                   twice corrected.
                                                                                                        Twice corrected.
                      30 The increase of the Anomalistic Equation for 3' 45' when the Argument
                                                                                                        Part 2.
Os
    59
           87
      1
          5)
                   is S' 12' 23', being 5', the Equation \frac{1^{\circ} 22' \cdot 45'' \times 5}{3 \cdot 45} = 1 50 applied to the
         53
                                                                                                        Thrice corrected.
                   Sur's mean diurnal motion, gives it thrice corrected.
4572
                 From the Chila carna answering to the Argument 10' 29' 22', subtract the
                                                                                                        Part 3.
3433
1134
          Radius.
          324
      5'
          53
                      From Mercury's mean diurnal motion, subtract the Sun's thrice corrected.
           34
       0'
            55"
                       Then the Equation \frac{3^{\circ}0^{\circ}31''\times1134'}{4579} = 45' 47" applied to the Sun's diurnal
                                                                                                        V's frue diurnal
  + 45
            47
                                                                                                        motion,
                     motion three times corrected, gives Mercury's true diurnal motion.
      4\ddot{o}
            45
  E. To find Mercury's Latitude from the same data.
     20°
           411
                       To the mean place of Mercury's Node, add the Anomalistic Equation (C,
                                                                                                       For his Latitude.
       4
            16
                     no. 4), which gives the Node's place corrected.
                                                                                                       His Nosle corrected.
      21
            57
     29°
                       From Mercury's mean Heliocentric place, subtract the corrected place of
                                                                                                       Table XXX.
                    his Node, and the Sine of the difference is 3425'. Mercury's greatest apparent
          51
                                                                                                       XLII, Part 3.
                    Latitude being 2°, its Sine is 120', and the Chila carna 4572 (D, no. 4). Hence
100' × 3'25' = 20' gives 1° 30' for the Latitude sought, which in this example is South.
                                                                                                        P's true Latitude.
   Note. The true places of Jupiter and Saturn are computed in the same manner, mutatis
                                                                                                       The Elements of 11
                                                                                                       and h compared
mutandis, with that of the Planet Mars, and the true place of Venus is computed like that of
                                                                                                       like those of 3;
                                                                                                       those of I like & s.
Mercury; so that it is needless to add more examples.
       To find Jupiter's mean place for the beginning of the 4900th year of the Cali yug,
                                                                                                       Jupiter, Table
                                                                                                       XLIII,
                                        To Jupiter's mean motion for 182618 days, add the
100000
                 20°
                       38'
                              3"
 $3,700
             5
                             27
                 17
                       42
                                      Druva 10' 13' 45' 16", and half the diurnal motion 2' 20",
  2000
                 16
                       11
                             24
   600
                 19
                       51
                             28
                                      which gives 0 10' 41' 1' for his mean place at midnight at
     10
                       49
                             51
                                                                                                       4's mean Heliocen-
      8
                       39
                             53
                                                                                                       tric place,
                                      the time given.
```

13.018

24

53

16

His Aphelion.

B. To find the place of Jupiter's Apsis and Node for the same period,

Since Jupiter's Apsis moves 1' in 222 years, we have  $\frac{1 \times 5 \text{ in}}{242} = 2' \cdot 15''$  for its motion in 500 years, and this added to the Druva gives 5° 21° 22′ 3″ for its place at the given period.

His Node.

And since his Node moves 1' in 1149 years, 1 × 500=20" is its motion in 500 years, which subtracted from the Drava gives 25 10° 40' 9" for its place at the time required.

Venus, Table XLIV

A. To find the mean place of Venus for the beginning of the 4500th year of the Cali yug.

|                                       | 100700 | 0  | 14  | 38 | 22 |
|---------------------------------------|--------|----|-----|----|----|
|                                       | S0000  | O  | 11  | 41 | 42 |
|                                       | 200    | 10 | 24  | 17 | 24 |
|                                       | 600    | S  | 1   | 17 | 16 |
| Index.                                | 10     | 0  | 10  | 1  | 17 |
| Mann place et                         | ន      | 0  | 12  | 49 | 2  |
| Mean place at mid-<br>night at Lauca, | 152£18 | 8  | ຂຸນ | 49 | 13 |

To Venus' mean motion for 182018 days, add the Druva (6 3) 88 22° 20′ 197, and half her mean diurnal motion 43′ 4″, which gives 5° 18° 54′ 56″ for her mean place at midnight at the time given.

B. To find the mean place of Venus' Apsis and Node for the same period.

Her Aphelion,

Since Venus' Apsis moves 1' in \$71 years, we have  $\frac{1 \times 500}{514} = 1' 20''$  for its motion in 500 years, and this added to the Druva gives 2' 15° 52' 6' for its place at the given period.

Her Node.

And since far Node moves 1' in 202 years,  $\frac{1 \times 5'90}{202} = 2' \cdot 15''$  is its motion in 500 years, and this subtracted from the Druva gives 1' 29' 39' 41" for its place at the time required.

Saturn, Table

A. To find Sa'urn's mean place for the beginning of the 4000th year of the Cali yog.

|                                      | 100000                | 3  | 13 | 55 | 51  |
|--------------------------------------|-----------------------|----|----|----|-----|
|                                      | <b>8</b> 600 <b>0</b> | 5  | 5  | 8  | 40  |
|                                      | 2000                  | 2  | G  | 52 | .13 |
| Index.                               | 600                   | 0  | 20 | 3  | 49  |
| - · · · ·                            | 10                    | O  | 0  | 20 | 4   |
| His mean place at midnight at Lanca, | 8                     | 0  | 0  | 16 | 3   |
| -                                    | 182018                | 11 | 16 | 37 | 10  |

To Saturn's mean motion for 182618 days, add the Druva 2° 25° 55′ 32″, and half his diurnal motion 1′ 0″, which gives 2° 15° 31′ 42″ for his mean place at midnight at the time given.

B. To find the place of Saturn's Apsis and Node for the same period.

His Aphelien.

Since Saturn's Apsis moves 1' in 5128 years, we have  $\frac{1 \times 500}{0.128} = 5''$  for its motion in 500 years, and this added to the Druva gives 7' 26° 37' 32' for its place at the time required.

His Node.

And since his Node moves 1' in 302 years,  $\frac{1' \times 500}{302} = 1' \cdot 30''$  is its motion in 500 years, which subtracted from the Druva gives 3' 10° 22' 0" for its place at the time required.

Arca Bhagébalas of the respective Planets, In using this method, the Area Bhagábala for Jupiter is supposed to be the 4334th part of the Sun's Equation; that for Venus the 598th part, and that for Saturn the 10300th part of the Sun's Equation.

These contractions are easily deduced from what was explained in the former section, it being only necessary to divide 360° by the mean diurnal motion of the Placet.

## PART III.

Method of computing the Declination, Ascension, Amplitude, &c. of the Planets, &c. &c. & Irasine wt

- A. GIVEN the Moon's true place in the Zodizc, her Latitude, and the Ayanansa, to find her Declination.
- 11s 9° 22′ 10 To the Moon's true place, add the Ayanansa, which gives the Moon's 19 29 11 28 51 Longitude, the Sine of which is 69′ and (9 × 1997) = 28, answers to the Decli-

nation of a point of the Ecliptic which has the same Longitude that the Moon has in her own Orbit.

- 4° 12' 2º Because the Moon's Latitude and the Declination just found are both South,
  23
  4 40 their sum is supposed to give the Moon's true South Declination.
- B. Given Mars' true place, the Aymansa, and his Entitude, to find his Declination.

Mars.

8s 16° 33' 19 20 To Mars' true place, add the Ayanansa, which gives his Longitude, the  $\frac{19}{9}$   $\frac{20}{6}$  Sine of which is 2416' and  $\frac{3410\%1297}{3435} = 1389'$ , which answers to 23° 51'

the Declination of that point of the Ecliptic which has the same Longitude that Mais has in his Orbit.

23° 51'
22 From the Declination thus found, which is Scuth, subtract Mars' Latitude,
which is North, and the difference is the Declination sought.

Given Mercury's true place, the Avanansa, and his Latitude, to find his Declination.

Mercury.

- 105 22° 21'
  19 29

  10 To Mercury's true place, add the Ayanansa for the Longitude, the

  11 11 50

  Sinc of which is 1072'; and  $\frac{1072' \times 1597}{5458} = 436'$ , which answers to 7° 17'
  the D-clination of the corresponding point of the Ecli; tic.
- 7° 17' 2? As the Declination of this point and Mercury's Latitude are both South, their sum is to be taken as Mercury's true Declination.

Note. — Although this method of finding the Declination of the Planets be not perfectly correct, yet the principles on which it is founded, are exceedingly obvious.

The Moon's Declination being supposed 4° 40' South, to find the Ascensional difference.

sional difference.

The Moor's Ascen-

For the Cshetijya  $\frac{967 \times 280}{5.09}$  = 82', and for the Charajya  $\frac{82' \times 3138'}{3\times6}$  = 82, which is the

Ascensional difference sought.

In both this and the last example the second operation might have been omitted, but that is only the case when the Declination happens to be small.

As the reader may be desirous to see how the mean Elements of the Planets are resolved by the Rules of the Surriah Siddhanta, I shall close this paper with summary examples for each. The manner of deducing their apparent places, therefrom, are the same as those indicated by Vavilala Cuchinna.

#### General Problem.

For the mean places of the Planets.

To find the mean distance of each Planet from the beginning of the Zodiac for the commencement of any year, which let it be that of the 4900th year of the Cali yug (falling on the 19th March 1798) at midnight, under the Meridian of Lanca.

Rule.

The Rule may be expressed as follows:

As the number of Bhumi-savan or natural days in a Maha yug;

Is to the number of Bhaganas, or mean Sydereal revolutions of the Planet, in the same time; So is the Strostidi Digona;

To the number of Revolutions and parts of a Revolution of the Planet in the same time.

N. B.—The complete Revolutions are seldom wanted; but the excess above complete Revolutions, gives the mean place of the Planet from the beginning of the Zodiac.

1? The Strostidi Digona being computed for the end of the Luni-solar year 4899 of the Cali yug, as indicated in the second part of the Key to the Siddhanta Chandra Mana, will be found to be 711404086004 Bhumi-savan days, of which there are 1577917823 in a Maha yug.

|               |    |                           | • /                                        |                         |     | 112 412 | a ju | <b>5</b> ' |
|---------------|----|---------------------------|--------------------------------------------|-------------------------|-----|---------|------|------------|
|               |    | R                         | evolutions. B. Savan days.                 | . Complete Revalutions. |     | Part    | s.   |            |
| O.            | 10 | For the Sun's mean place  | 4320000×714401086001<br>1577917328         | = (195£33439 <b>6</b> ) | 11s | 4°      | 45'  | 15*        |
| <b>&gt;</b> . | 20 | For the Moon's mean place | 5175305.6×11440_036004<br>1511917898       | = (261478°8366)         | 11  | 11      | 28   | 29         |
| <b>♂</b> ·    | 30 | For Mars' mean place      | <u> 2296ドラミ×キ1 454086664</u><br>1577917525 | = (1039S93292)          | 7   | 13      | 13   | 26         |
| <b>پ.</b>     | 40 | For Mercury's mean place  | 17937060×714401080004                      | = (8121024255)          | 9   | 29      | 47   | 7          |
| <b>4</b> .    | 5° | For Jupiter's mean place  | 361220×711401056904<br>1577917528          | = (164901018)           | 0   | 10      | 41   | 1          |
| ♀.            | 60 | For Venus' mean place     | 7022376×711101086004                       | = (3179338697)          | 5   | 13      | 54   | 3 <b>6</b> |
| ħ.            | 70 | For Saturn's mean place   | 146568×714404086004                        | = (663588 <b>2</b> S)   | 2   | 15      | 31   | 42         |

For the mean distances of the higher Apsides from the beginning of the Hindu Zodiac.

For the higher Apsides of the Planets,

To find the mean distances of the higher Apsides and ascending Nodes of the Planets from the beginning of the Zediac, for the commencement of the 4900th year of the Calipus, the rule

2.4.

S. S.

 $\Omega$ . b.

differs in nothing from that in the last article; only that instead of a Maha yug, a Calpa (or 1000 Maha yugs) is made use of for this purpose; excepting for the Moon.

| 1º For the Sun's Apogee                                   | Revolutions. Bhumi Savan days.  \[ \frac{387 \times 714404086004}{1577917825000} =  (175)  2\structure 17\structure 16'' \] | Apogee.  O A                  |
|-----------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------|-------------------------------|
| 2º For the Moon's Apogee A Maha y                         | - T                                                                                                                         | D A                           |
| For the Bijah or correction (*)                           | - 4×714404086004 Moon's Apogee 10 17 39 5                                                                                   |                               |
| 30 For Mars' Aphelion                                     | $\frac{20^{\circ} \times 714^{\circ}04086004}{\text{A Calpa } 1577917828000} = (92) 4 10 2 35$                              | Aphelion.                     |
| 49 For Mercury's Aphelion                                 | $-\frac{368 \times 714404086004}{1577917825000} = (166) 7 10 23 12$                                                         | <b>보 A</b>                    |
| 5ª For Jupiter's Aphelion                                 | $-\frac{900\times114404086004}{1577917828000} = (407) 5 21 22 3$                                                            | 4 A                           |
| 60 For Venus' Aphelion                                    | $-\frac{535 \times 71440408^{\circ}004}{15779178280000} = (242) 2 19 52 6$                                                  | Ŷ <b>A</b>                    |
| 7º For Saturn's Aphelion                                  | $-\frac{30\times114404086004}{1517917625000} = (17) 7 26 37 32$                                                             | <b>Ъ</b> А                    |
| For the                                                   | place of the Nodes.                                                                                                         |                               |
| The rule is the same as for the upper A                   | Apsis of the Planets, with this only difference, that they                                                                  | For the Nodes of the Planets. |
| are all supposed to move in Antecedentia                  | or retrograde.                                                                                                              |                               |
| Revolutions, Bi 232238×71  For the Moon's Node A Mana yeg | numi Savan days. 1440 08004 15779178.8 = (105146017) 105 9° 48′ 16″                                                         | Ω· D·                         |
| The Bijah th                                              | he same as for the Apogee + 0 1 33 1                                                                                        |                               |
| Place of D'                                               | s Node 10 11 26 17 and its                                                                                                  |                               |
| supplement to 12s is 1s 48° 33' 43".                      |                                                                                                                             |                               |
| 2? For Mars' Node - A Calpa 10779                         | 4301086004 = (96) 103 19° 56′ 50″ and its supplement                                                                        | Ω. ♂.                         |
| 20 Fra Managaranta Mada                                   | 140108^004 = (220) 11 9 19 9 and its supplement                                                                             | α. ¥.                         |

= (78) 9 10 19 51 and its supplement

= (108) 10 0 20 19 and its supplement

= (299) 8 19 39 0 and its supplement

to 126 is 3s 10° 31′ 0". N. B .- The places of the Flanets may be resolved from the beginning of the Cali yag by

171×714401056004

903×714404056004

1011011020000 1011011020000

to 12, is 0s 20° 40′ 51".

to 12; is 25 19° 40' 9".

to 12s is 1s 29° 39′ 41″.

40 For Jupiter's Node

50 For Venus' Node

60 For Saturn's Node

<sup>(\*)</sup> The B jah is prescribed by the Tika, but not by the Survial Siddianta,

means of Table XX, XXI, XLI, XLII, XLIII, XLIV, and XLV, when the Ahargana is known. But for the Aphelions and Nodes, if these Tables be used, the Epochs and Druvas given at the foot of the Tables must be referred to, and the Index must be computed as shewn at Part III, Article 2, of the Key to the Siddhanta Chandra Mana.

END OF THE APPENDIX TO THE SECOND MEMOIR.

# THIRD MEMOIR.

ON THE

INDIAN CYCLE of 60 YEARS

or

VRIHASPATI CHACRA;

OR

CIRCLE OF JUPITER.

|   |  | • |  |
|---|--|---|--|
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
|   |  |   |  |
| • |  |   |  |
|   |  |   |  |
|   |  |   |  |

## ADVERTISEMENT.

----

THE Indian Cycle of 60 years, or Vrihaspati Chacra, in any one of its forms, is of little, or no use in the resolution of Astronomical Problems. The Tellinga Astronomers alone, apply theirs to the computation of the years elapsed of the Cali yug, for finding the Ahargana and Soota dina, or day of the full or new Moon.

But in a Chronological point of view Jupiter's Cycle is important, because it was ever a practice in Southern India, when dating documents, to annex the name of the year of the Chacra to that of the concurrent Solar and Luni-solar years; and as we know of three different styles bearing the same denomination, two of which occasionally expunge one Chacra year out of the Kalendar, whereas the third (also under the name of Vrihaspati) records merely common Solar years, without any omission, it follows that in verifying dates, great mistakes may be made, if attending merely to the name or numeral of the Chacra year. It will be seen in the following pages, that in present times the expunged years of the Jyautistava Style, precedes those of the Surriah Siddhanta by 13 years; and that the whole of the Chacra or Cycle, according to the Tellinga Astronomers, whilst in reality it was 56 years in A. D. 1800 behind those of the two former authorities, yet from their manner of telling off the odd years of the Cycle, it seems to lose only 11 years in the said Christian year.

A view of the Epochs of expunged years from the beginning of the Cali yug to Ao 5128 complete (A. D. 2026) according to the Surviah Siddhanta, is given in a separate Table (XVIII, page 20), and in another (XIX, page 23) the same, according to the Jyautistava, from the birth of Salivahana (A. C. 3179, A. D. 73) down to the 2033d Christian year. It also exhibits the difference of Epochs of the two Styles.

These Tables will suffice to rectify by inspection, any date recorded in Vribaspati years only (which sometimes happens on old inscriptions, when that of the other Styles is obliterated by time), provided it be known to which Style it belongs; a circumstance which must depend on the country which gave birth to the document.



|   |   | • |  |
|---|---|---|--|
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
| - |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   | • |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |
|   |   |   |  |

# On the Indian Cycle of 60 YEARS or VRIHASPATI CHACRA. (\*)

-----

I HAVE not been able to discover the origin of the practice of reckoning time with reference to the revolutions of the Planet Jupiter, but it is no doubt very ancient; not only from there being nothing on record, but from the circumstance of its legitimate application having (if it ever did) long since fallen into disuse in the Peninsula of India, where 60 Solar years are supposed to be equal to five revolutions of the Planet, a proposition which is warranted neither by the Surriah Siddhanta, the Tikas, nor observation.—Generally, one year of Jupiter's Cycle is supposed to answer to the time during which the Planet passes through one Sign of the Zodiac.

The mean Solar Sydereal year, according to the Surriah Siddhanta, consists of 365th 15th 31th 24th (neglecting 24 suras). Of Jupiter's revolutions there are 364220 in a Maha yug; therefore Jupiter's motion in a Solar year is  $\frac{36.4220}{4320000} = 1the 0the 21the 6the exactly. Subsequent Astronomers however, finding that this quantity deviated from the observation, have imagined a correction of 8 revolutions of the Planet in a Maha yug; whence we have, as 4320000 to 8 revolutions, so one Solar year of 3650 15the 31th 31the 2the correction or Bijab, which is subtractive;$ 

Solar year of the Surviah Siddhanta 365d 15g31v31p24s U's motion uncor-

rected is, 0° 2' 6"

Bijah 2<sup>n</sup> 24<sup>n</sup> per

Therefore - 1' 0' 21' 6" 0"

Bijah - 2 2 21

Corrected motion in 1 Solar year - 1 0 21 3 36

In order to have Jupiter's year expressed in Solar time we have, as 30° 21' 3" 36" to 3650 15° 31°, so 30° to 3610 2° 4° 44°,2323 &c. the true duration of the Chacra year.

Motion in 1 Solar yearls, 0°21/3"36" U's year 3610 2d 4p 44c,2329 in Solar

time.

Such are the quantities which govern the Tables at the end, constructed for the purpose of abridging these long and tedious operations.

There are several Rules for computing the years of the Chacra, three of which I shall consider as being the most in use, viz. 10 That of the Surriah Siddhanta; 20 that of the Jyautistava; and 30 that of the Tellingas, the latter of which is followed in the Southern parts of India.

Three Rules or Styles for the Cycle of all years.

Mr. Davis has explained in a general manner the theory of the two former, in a Memoir published in the IIId volume of the Asiatic Researches, but as it required much extension to reduce the respective problems to practice, I shall enter more minutely into the subject than he did.

<sup>(\*)</sup> This Cycle has been imagined, but without foundation, to be the same as the Chaldean Sasos.

## According to the Surriah Siddhanta.

Precept by the Sur-

"Multiply by 12 Jupiter's expired bhaganas (revolutions) and (to the product) add the Sign he is in; divide (the sum) by 60, the remainder or fraction shews his current year, counting from Vijaya" (the 27th of the Chacra inclusive) "as the first of the series." (Asiat. Researches, volume III, page 213).

How to find Jupiter's elapsed revolutions and mean Heliocentric Longitude at any given Epoch, will be shewn in another part of this collection. At present let it be understood, that it may be readily obtained by means of Table XI. As for the Bijah, Mr. Davis has shewn that 4320000 years are to 8 revolutions, as 1500 years, to 1. Hence 1500: 1::  $x: \frac{x}{1500}$ , which is the general expression of the Bijah, x representing the years expired since the commencement of the Cali yeg, when the Planets were supposed to be in conjunction in the first point of the Hindu Zodiac.

#### EXAMPLE I.

Example by the Rule.

Let it be proposed to find the rank, name and beginning of the Vrihaspati year concurring with A. C. 4871, relatively to the commencement of the said Solar Sydereal year current, or 4870 complete.

Say, as 4320000 Solar years, to 364220 revolutions of Jupiter, so 4870° to 410° 7° 2° 37′ 0° the revolutions and Longitude of  $\mu$ , at the end of the said year.

For the Bijah we have 
$$\frac{4870}{1500} = - 0^{\circ} 3^{\circ} 14' 48'$$

Longitude uncorrected - 7 2 37 0

21's mean Heliocentric Longitude corrected 6 29 22 13

For the number of Cycles expired and years current.

Remainder 7 years, from Vijaya, the 27th year of the Chacra inclusive, which therefore makes Vicari the 33d, the year current. But here it is to be remembered, that the numeral 33 is merely nominal, as will be shewn hereafter.

For the time of beginning of the said year Vicari, relatively to that of the concurrent Solar year 4371, say, as 2° 30′ to 1 month of 30 days of Jupiter's own time, so 29° 22′ 12″ (the remaining part of the Longitude) to 11 months, 22 days (352°), 26 dandas, 23 palas, 19,80 castacalas of Saura time, which shews the portion of the Planet's time in the year Vicari expired on the 1st Chaitram (Bengal Vaisácha) A. C. 4871 current.

Now to have the precise date in Solar time, say as before (page 199), as 30° 21′ 3″ 36″ to 365s 15° 31° 31°, so 29° 22′ 12″ to 353s 27° 10° 31° (\*), the number of Solar days, dandas, &c. elapsed of Vicari on the 1st Chaitram 4871 of the Cali yug.

For the date of the beginning of the said Vrihaspati year according to the Christian Kalendar, finding by the General Solar Table at the end of the volume, that the year Cali yugam 4870 ended on the 9th April 1769 N. S. it follows that the commencement of the year Vicari fell on the 21st April 1768.

Date of the beginning of the Vrihaspati year according to the European Kalendar.

And if the Civil date according to the Hindu Solar Style be required, the process indicated in the preceding Memoir, is to be followed.

According to the Hindu Solar Kalendar.

How to compute the same by the Tables.

Let Jupiter's mean Heliocentric Longitude for the end of the same year Cali yugam 4870, be required. Then by Table XI, we have

The same by the Tables.

```
Epoch 4400
                         Druva
                                                370 11 17 20
                         Column III, 400
               4870
                                                 33
                                                      8 20 40
                                 11,
                                      70
                                                   5 10 24 37
                 470
                                                410
                                                         2 37
                                       Bijah ~
                                                         3 14 48
For the Bijah, Table XII, page 15.
                                                 410
                                                      6 29 22 12
Epoch 4400
                                                 12
  Druva
                        56'
                             0"
Column III,
                             0
                                               4920
             400
                        16
                          2 48
                                   for 6°
Column II,
                                              十 7
                                                  - Cycle, y.
                                            60)4927( 82
      Bijah -
                     3 14 48
                                                           7 from Vijaya the 27th.
                                                127
 Therefore Vicari the year current
         For the Solar time due to
                                    29 22
                                                By Table XIII, page 16.
                                            12
                Column I, 20°
                                  240 41
                                            23
                                                 9,4886
                            9
                                   108 18
                                                25,2699
                                            37
                       II, 20'
                                        0
                                            41
                                                23,1531
                                       24
                                             4
                                                 8,3159
                      III, 10"
                                             0
                                                20,6929
```

Solar time expired of Vicari - 353p 274 109 31°,0640

The same (neglecting the decimals) as in the preceding Rule.

N. B.—The Table XLIII (page 56 of the Tables) of Vavilala Cuchinna, give 2's motion in 30 days 2° 29' 31" 24", which for one Solar year amount to 1° 0° 21' 3" 26", differing only from the

78895891c

24

4,1386

```
(*) For 4's year expressed in Solar time, sny :

As 30° 21' 3" 36" : $650 15d 31p 31c :: 30° : 3610 9
```

30°: 361p 2d 4p 44c,23293 6350000\*\* 77983484,23293

The length of Jupiter's year, which governs Table XIII, page 16,

65558167

quantity given by the Surriah Siddhanta, (corrected by the Bijah) by 10", answering to 2 pal. 0,3448 cast. in Solar time.

RULE.

The same according to the Jyautistava (a book on Astrology.)

Jyantistava Rule.

This Rule expounds the last expired, instead of the current year of the Chacra.

Precept.

"The Saca years note down in two places. Multiply (one of the numbers) by 22. Add (to the product) 4291. Divide (the sum) by 1875. The quotient (its integers) add to the 2d number noted down, and divide (the sum) by 60. The remainder or fraction will show the last year expired, counting from Prabhava (inclusive) as the first of the Cycle. The fraction, if any left by the divisor 1875, may be reduced to months, days, &c. expired of the current year." (Asiat. Res. vol. III, p. 214).

1st result in Saura

The Jyantistava uses the Solar year according to the Aria Saddhanta 365d 15 31 15. Here it is proper to observe, that the fraction of the first term when amounting to unit represents one Chacra year of 360 days, which the Hindus call Saura time; therefore, in order to have the true Solar time clapsed it will be, as 360° Saura to 365° 15° 31° 15° (the duration of the Solar year according to the Aria Siddhanta), so is the number of Saura days elicited by the fraction reduced into time, to the corresponding number of days, &c. in Solar Sydereal time.

## EXAMPLE II.

Trample by the Rule.

Let the year of the Cali yug 4370, or (1870-3179, 1691 Saca complete, be proposed: wanted the circumstances of the concurrent Vrihaspati year.

By the foregoing precept we have 1691.

5m 17d 36dan, 57p

$$\frac{1691 \times 92 + 1991}{1875} = 22 \frac{873}{1875}$$
 and  $\frac{1691 + 92}{60} = 23 \frac{33}{60}$ 

The first fraction when reduced into time  $(\frac{873}{1375})$ , shews that 5m 17d 36dan 57p,6 had expired of the year indicated by the 2d fraction  $(\frac{3}{50})$ , i. e. Vicari, on the 1st Chaitram of the year 1692 Saca current, in Saura time; to reduce which into Solar time we have, as SGDD: 365D 15d 31p,25:: 5m 17d (167d) 36dan 57p,6: 170D 3d 51p,91 or 170D 3d 51p 54,7cast. And as the Solar year began on the 9th April A. D. 1769 (\*), it follows that (according to this Rule) the Chacra year Sarvari (the 34th and current one) began on the 21st October A. D. 1768.

In comparing hereafter the results of the two foregoing Rules, we shall thus find them expressed in the same species of time, which Mr. Davis has omitted to consider.

How to compute the same by the Tables.

The fraction of the first member of the expression will be expounded as follows, by Table XIV, page 16.

The same by the Tables,

| Nr              | merator  |        | <b>p.</b> d | an. p.  |
|-----------------|----------|--------|-------------|---------|
| Column III, for | 800      |        |             | 86 O    |
| II,             | 70       | -      | 13          | 26 24   |
| I,              | 3        | -      |             | 34 33,6 |
| P,6             | in Saura | ı time | 167         | 36 57.6 |

To reduce which to Solar time, by Table XVI, page 18.

The same result as by the Rule.

#### ILLUSTRATION.

The multiplier 22, and the divisor 1875, are explained in the following manner by Mr. Davis. According to the Astronomical treatise called the Aria Siddhanta, there are 364224 mean revolutions of Jupiter in a Maha yug (instead of 364220 assigned by the Surriah Siddhanta, the Solar years of the latter being 3650 15d 31p 31c and of the former 3650 15d 31p 15s); therefore 364224 rev. contain 4370088 of the Planet's own years, which exceed the Solar years in a Maha yug by 50688', and 4320000' and 50688 being reduced to their lowest terms are 1875 and 22; therefore in 1875 Solar years, there is an excess of 22 Vrihaspati years.

Illustration.

According to the Aria Siddbanta 364324 rev. of  $\mathcal{U}$  in a Maha yug.

The additive number (1st member) 4291, by the Hindu Astronomers called *Cshepa*, adjusts the computation to the commencement of the Æra Saca, or the birth of Salivahana, which occurred when 3179 years of the Cali yug had expired. In order, therefore, to have the time elapsed of the Vrihaspati account at that Epoch, if we use the above formula it will be  $\frac{60 \times 22 + 4231}{1275} = 2 \cdot \frac{511}{1275}$  and  $\frac{60 + 2}{60} = 0 \cdot \frac{2}{60} = \frac{4291}{1275} = 2y \cdot 3m \cdot 13d \cdot 52 \cdot dan. 19p,2 in Saura$ 

Cshepa, an Equation which adapts a computation to a particular period.

time, and 2y 105d 23Jan. 21p 29c,8872 (Table XVI) of mean Solar Sydercal time, which had already expired of the 54th Cycle when that Æra began. (\*)

Epoch of Vrihaspati reduced to the Æra of Salivahana.

3 errs

| Epoch 4400<br>3179                                               | Table XI, | Colum | ı III, | 500     |   | 16         | 3<br>19   | 10  | 20       | 0      |     |
|------------------------------------------------------------------|-----------|-------|--------|---------|---|------------|-----------|-----|----------|--------|-----|
| 1221                                                             |           |       | 11,    | 1<br>20 | : | 0          |           |     | 21<br>21 | 0<br>6 |     |
| <b>35</b> at 2011 t                                              | Dieva     |       |        | 1221    | - | 102<br>570 |           |     | 23<br>20 |        | •   |
| For the Bijah, Table XII.  Column III, 1079 - 40 0 0 200 - 8 0 0 | Bijah     |       | •      | -       |   | 268        | 0         | 7 2 | 56<br>7  |        | 38# |
| 200 - \$ 0 0<br>II, - 20 - 48 0<br>I, - 1 - 2 24                 |           |       |        |         | - | 268<br>12  | 0         | 5   | 49       | 44     | 51  |
| Druva - 1921 - 48 50 24<br>2 - 53 0 0                            |           |       |        |         |   | 536<br>680 |           |     |          |        |     |
| Bijah - 2 - 7 9 36                                               |           | R     | .emair |         | 5 |            | с.<br>3 ; | •   |          |        |     |

<sup>(\*)</sup> In order to compare this Epoch as expounded by the two Rules, we shall compute the same by that of the Surrick Siddhanta, as follows:

#### RULE.

## According to the Tellinga Astronomers.

Rule according to the Tellingas.

This Rule gives the last expired year from the beginning of the Cali yug: it takes no notice of the commencement of the Vrihaspati year, which it identifies with that of the Chandra mana, or Luni-solar year current.

Precept.

"Divide the expired years of the Cali yog by 60, the quotient will give the number of Cycles expired, and the first year of the remainder will answer to Pramathi the 13th year of the Chacra. Count the number of units of the said remainder from the said Pramathi (inclusive), you have the year of the Chacra last expired, and that which follows is the current one."

#### EXAMPLE.

Rule.

Let it be proposed to find the rank and name of the Vrihaspati year concurrent with A. C. 4870 complete, or 4871 current.

By the above precept we have

and the numerator of the fraction 10 being told off from Pramathi inclusive, gives Sarvadhari the 22d, as the last expired, and Virodhi the 23d, as the current year sought; the integers shewing that 81 Cycles have elapsed since the beginning of the Cali yug, and therefore that the 82d is the current one.

### Comparison of the three results.

Comparison of the

In order to compare the number of Cycles and years expired according to each Rule, we are not to refer to the numerals of the Chacra years, as arranged in the series given in modern Astronomical books; because each authority begins from a different point of the Chacra for counting the odd years after division by 60; without any reference to the revolutions of the Planet at any given Epoch, which nevertheless are the true scale by which such time should be measured.

which remainder 37, counted from Vijaya the 27th of the Chacra, falls on Suda the 3d year current of the 54th Cycle complete; and for the time due to 5° 49′ 44″ 24″ Longitude of the Planet on the 1st day of the Solar year Cali yugam 3180, we have

|                                        |       |         |       |       |          | D.  | ø. | b. | e.       |
|----------------------------------------|-------|---------|-------|-------|----------|-----|----|----|----------|
| Table XIII, Column 1,                  | 5•    | •       |       | •     | -        | 60  | 10 | ٤0 | 47.3722  |
| 11,                                    | 40'   | •       | -     | •     | -        | 8   | I  | 28 | 46,3163  |
| ,                                      | 9     | -       | -     | -     | -        | 1   | 48 | 18 | 37,4212  |
| III,                                   | 404   | _       | -     | -     | -        | -   | 8  | 1  | 22,7719- |
| ,                                      | 4     | -       | -     |       | -        | -   |    | 48 | 8,2772   |
| 1V,                                    | 20*   | -       |       | -     | -        | •   |    | 4  | 0,6897   |
| ,                                      | 4     |         |       | •     | -        | •   |    | •  | 48,1380  |
|                                        |       |         | Cycle | 8.    |          |     |    |    |          |
| Solar time expired at the beginning of | the Æ | ra Saca | 54    |       | years.   | 70  | 8  | 56 | 30,9865  |
| •                                      |       |         |       | 2     | <b>3</b> | 105 | 23 | 21 | 29,8872  |
|                                        |       |         |       | Diffe | rence    | 35  | 14 | 24 | 58,9007  |

The Surriah Siddhanta, from counting the odd years from Vijaya (the 27th) as one or Nandana By the Surriah Sid-(26th) as zero, considers manifestly that Jupiter and the Sun were once in the first point of Mesha at the beginning of Vijaya and of the Cali yug. Thus in Example I, page 200, we found that at the end of the Solar year of the Cali yug 4870, the current Chacra year was Vicari (33d) and the last expired Vilamva (32d) of the 83d Cycle current. But the revolutions and Longitude of Jupiter at that instant were 410° 6° 29° 22' 12", which gave 82° 67 complete, the 6 years to be counted from Nandana as zero, and therefore Vilamva the 6th in the series marks the true time elapsed, and not Vilamva the 32d, as numbered in the modern list. The former is consequently that to be used for comparison.

20 The Jyautistava rale which computes in Solar years, but with reference to Jupiter's By the Jyautistava. motion, takes the series to be numbered as in the list referred to, viz. Cshaya the 60th year of the Chacra as zero and Prabhava as onc. But in so doing it uses a Cshepa of 27 years earlier than the Surriah Siddhanta, which adapts the numerator of the fraction of the second member of its rule, to the year elicited by the latter.

Thus in Example 2, page 202, the cycles and years expired in the year Cali yug 4870 complete from the birth of Salivahana are, 28 cycles, 33 years, to which adding 54 years, we have for the cycles and years expired since the beginning of the Cali vug 82° 337, if from this we subtract 27

we have 
$$\frac{-27}{82-6}$$
, the same numbers as those

elicited by the rule of the Surriah Siddhanta when taking Vijaya as 1 of the series.

30 With respect to the Tellingas, as their account is entirely Solar without any reference to the motion of Japiter, the difference is exactly that arising out of the Solar and Vrihaspati years expired. Hence if we divide the year of the Cali yug 4870 by 60,

According to Tellingus.

which 56 years mark the number of expunged or Cshaya years which have occurred since the beginning of the Cali yug, as will be shewn from other principles.

From the foregoing considerations it follows, that the relative measure of time of the respective accounts is not to be deduced from the numerals of the years of the Chacra according to our list, but from the actual revolutions of the Planet as expounded at page 200, Example I, the former giving the following erroncous results, viz.

a first view might be supposed to be the correct ones.

## Of the Cshaya or expunged year.

Of the expurged year according to the Surrich Siddhanti, with the correction of the T.k... I shall now proceed to explain the occasion of the Cshaya, or expunsed year of Jupiter due at certain periods, resulting from the theories of the Surriah Siddhanta and Jyautistava, that omission being unknown to the Tellingas.

#### Surrigh SidJhanta.

We have seen at page 199, that the mean motion of Jupiter in Heliocentric Longitude according to the Surrish Siddhanta (corrected as the Tika directs), in a Solar year of 2650 154 319 31c, is

1' 0' 21' 3" 36"

| d 31p 31c, is | Multiply by                      | -       |   | -<br>- | =  | 1' | O° | 21'       | - | 36 <b>*</b><br>85 |
|---------------|----------------------------------|---------|---|--------|----|----|----|-----------|---|-------------------|
| Mean motion   | during 35 Sola<br>Add motion for |         | - | -      | 7" |    |    | 50<br>-11 |   |                   |
| Mean motion   | during SS Solar                  | r years | - | -      | 7  | 3  | 0  | 11        | 9 | 36                |

Here it will be perceived that during the interval from 85 to 86 Solar years, the degrees pass from 29 to 30; and the signs from 1 to 3; and as the signs represent years of the Pianet, it is clear that between 85 and 86 years the name of one of the Chacra is to be omitted.

In order to ascertain the precise period in Solar time, multiply the duration of one Solar

| year | w .                              | • .   |           | •          |   | by | 365p         | 15 <sup>d</sup> | 31°<br>× | 31°<br>86             |
|------|----------------------------------|-------|-----------|------------|---|----|--------------|-----------------|----------|-----------------------|
|      | ⊙ sum of days                    | -     | -         | ₩          | - | 3  | 1412         | 15              | 10       | 26                    |
|      | And the duration o               | flof4 | 's year ( | page 199)  | - | by | 361          | 2               | 4        | 41,23293<br>87        |
|      | 24's sum of days<br>⊙ sum of do. | -     | -         |            |   |    | 1410<br>1412 |                 | 52<br>10 | 8,2650 <b>1</b><br>26 |
|      |                                  |       |           | Difference |   |    |              |                 | 13       | 17,73499              |

which difference answers to 11' 9" 36" of Longitude in degrees above found (vide Table XIII, page 16 of the Tables).

It appears therefore, that 86 Solar years answer to 87' 20 14' 13' 17',73199 &c. of Jupiter's time (the days, dandas, &c. expressed in Solar time,) and that 7' 3' 0' 11' 9' 36" of his motion in Longitude have a constant ratio to the period of recurrence of the expunged year.

Let 4's Longitude at the end of the Solar year Cali yugam 4571, computed by Table XI and XII be, with the number of his expired revolutions

- 410° 7' 29° 43' 15″ 36″ add

You have 8 signs without a remainder

- 410 8 0 0 0 0

Now 16' 44" 24" (Table XIII) answer to 3D 21' 27" 26', 4027 of Solar time very nearly.

It follows therefore, that a Cshaya or expunged year will be due in the Solar year 4872 current, when 3D 21<sup>a</sup> 27<sup>7</sup> 26<sup>c</sup> of the month Chaitram have expired.

To the Solar year 4871, add 86 years, the sum will be 4957 complete.

But by Table XIII, 5' 34' 43" answer to 10 7' 9" 8',8009, therefore the expunged year was due in the Solar year 4958 current, when 10 7' 9" 8' of the month Chaitram had expired.

time by Table XVII, page 18, will be

| Sølar.                        | So'ar. |   |   |                 |           | Of Jupiter. |          |                         |  |  |  |
|-------------------------------|--------|---|---|-----------------|-----------|-------------|----------|-------------------------|--|--|--|
| Column 2, 80                  | -      |   | - | <b>y.</b><br>80 | р.<br>337 | d.<br>55    | р.<br>42 | c.<br>21, <b>2</b> 416  |  |  |  |
| 5                             | -      | - | _ | 5               | 21        | 7           | 13       | <b>53</b> ,82 <b>74</b> |  |  |  |
|                               |        |   |   | +               | 363       | 1           | 13       | 13,3932                 |  |  |  |
|                               |        |   |   | 2)              |           |             |          | 28,4672                 |  |  |  |
| One year of Jupiter, page 199 | ***    | w |   | •               | (361      | 2           | 4        | 44,2336)                |  |  |  |
| Sum of U's years              |        |   |   | 87              | 0         | 0           | 0        | 0                       |  |  |  |

Period of the Cshaya 85y 3630 Id 13p 13c,3982.

Therefore 85' 3630 14 13', \$982 &c. of Solar time, answer precisely to 87 years of Jupiter's, and the former quantity marks in Solar time the period when one of Jupiter's years is to be expunged. This is the quantity which governs Table XVIII, page 20, where the Epoch of every Cshaya due since the beginning of the Cali yug is exhibited. (\*)

It need hardly be hinted that the Equation 16' 44" 24" added to the process for the year 4371, and 5' 34" 48" for the year 4957, when added together amount to 11' 9" 36", the common excess of 4's Longitude over 3 signs in 86 Solar years, as has been shewn at page 206.

In the preceding Examples, as the degrees of  $\mathcal{L}$ 's Longitude did not amount to a whole sign when the Solar year began, the *Cshaya* was due in the beginning of the following Solar year: but if we continue as before for the next period, viz.

<sup>(\*)</sup> The mean difference used in that Table is 85y 363 1 I3 13,3989, differing from the above 10003.

As the minutes, seconds and thirds exceed a complete sign (whereas the same quantity was wanting from it in the preceding Example), it shows that the *Cshaya* was due before the end of the Solar year 5043; and that the interval of time wanting to reach it, is that which answers to 5'34' 48", viz. 19 7d 99 85,6009: so that the precise Solar Epoch is A. C. 5043y 354p 8d 22p 22c,1991.

By help of these observations, the construction and use of the Tables from XI to XVIII may be easily understood and demonstrated.

I shall now turn to the consideration of the periods of the expunsed years of the Chacra according to the Janutistava account, the theory of which is rather more intricate than that of the foregoing style.

Of the expunged year according to the Rule of the Jyautistava.

Periods of Jupiter according to the Aria Siddhanta 4370638 revolutions in a Maha yug. We have already observed (page 202) that the Jyautistava follows the periods of the Aria Siddhanta, which assigns 4370688 revolutions of Jupiter in a Maha yug, or 4320000 mean Solar Sydereal years, the duration of each being 3650 15d 31p,25. It appears, however, that the author of the rule has occasionally warped these quantities, so as to make them fit his system, which represents the duration of one year of  $\mathcal{L}$  to be equal to  $\frac{1875}{1675}$ , and which fraction serves to express the different circumstances of the Problem.

Jupiter's year 355 49 29,95255 in Saura, and 361 1 21,65194 in mean Solar Sydercal time, for which see Table XVI, page 18.

From what precedes, Jupiter's year is  $\frac{4120000}{3370000}$  — Oy 11m 25p 49d 20p,95255, &c. or 355p 49d 29p,95, &c. expressed in Saura time of 360 days in the year.

In order to have the same expressed in Solar Sydereal time, say, as 3600: to 3650 15d S1p,25, so is 355 49 29,95255, &c. to 3610 1d 21p;6496, which is the duration of the Vrihaspati year according to the Aria Siddhanta.

It will be shewn however, presently, that the Jyautistava takes the Vrihaspati year nearer to 3550 496 309,418604, &c. of Saura time, the difference being 09,466050, and that in one of its Equations, it retrenches 29,03239, &c. from the duration of the same, for no other purpose, that I could discover, than to fit the theory to the rule.

Of the occasion of the Cshaya year.

Of the occasion of the Cshaya,

Let the circumstances of the Vrihaspati year concurring with A. C. 4858 or 1679 Saca, be computed; there will be  $\frac{1679 \times 22 + 4291}{1875} = 21 \frac{1854}{1875}$  and  $\frac{1679 + 21}{60} = 28 \frac{20}{60}$ .

Use Table XIV, page 16. The 1st term reduced into Saura time will give 21 years, 11m 25v 58d,4, by which quantity (at that period) the Vrihaspati had advanced before the Solar time, and the last member of the rule shews that 28 cycles and 20 years had elapsed since the Epoch. Vijaya was therefore, the last expired year, being the 20th of the Chacra, and Sarvajit the 21st, the current one, of which the above number of Saura months and days had expired on the 1st Chaitram (Bengal Vaisacha), or the beginning of the Solar year 1680.

Compute now for the ensuing year Cali yug 4859, or 1680 Saca.

$$\frac{1680 \times 22 + 4891}{1875} = 22 \frac{1}{1575}$$
 and  $\frac{1680 + 29}{60} = 23 \frac{29}{60}$ 

Here it will be perceived, that the first member has passed from  $21\frac{1854}{1875}$  to  $22\frac{1}{1875}$  and the second from  $28\frac{20}{60}$  to  $23\frac{20}{60}$ , the numerators of the last fractions 20 and 22 shewing that in the space of one Solar year, one of the Chacra is to be passed over: Hence, on the beginning of the Solar year 1681 the last *Vrihaspati* year expired is not *Sarvadhari* the 22d, but *Virodhi* the 23d.

Again, as in the computation for 1679 the fraction of the 1st member was  $\frac{185}{187}\frac{4}{5}$ , which answered to  $11^{10}$  250 584,4 Saura time expired, there wanted only 40 1d 56p for reaching the commencement of the next Chacra year Sarvadhari.

But in the rule for 1680, the fraction of the 1st term was  $\frac{1}{1873}$  answering to 11d 31p,2 Saura time already elapsed on the 1st Chaitram since the year Sarvadhari had ended. Hence the whole of the Chacra year Sarvadhari was expended during the Saca year 1630 current, on which account (like the Lunar Tidhis which begin and end in the same Solar day in the Chandra Mana) that year is expunged out of the Kalendar.

Cause of the Cshaya.

Illustration.

In order to account for that circumstance, we shall consider generally the period of recurrence of the expunged year.

It is to be observed that, the only variable quantity of the first member of the rule is the numeral of the Solar year for which the time is computed, and as that quantity is always multiplied by 22, it follows that the first term increases yearly by  $\frac{22}{1875}$ , and if we raise this quantity by 86, the first term will increase by  $(86 \times \frac{28}{1875})$  1y  $\frac{17}{1375}$  in 86 years.

Thus if we compute for the years Saca 572 and 658, we shall have for 86 Solar years

1st. 
$$\frac{57? \times \frac{92 + 1291}{1875}}{1875} = 9 \frac{0}{1875}$$
 and  $\frac{572 + 9}{60} = 9 \frac{41}{60}$ .  
2d.  $\frac{658 \times 22 + 4291}{1875} = 10 \frac{17}{1875}$  and  $\frac{658 + 10}{60} = 11 \frac{8}{60}$ .  
2d. (11° 8' or) 10° 68'  $\frac{1}{7} \frac{17}{1875}$   
1st.  $\frac{9}{41} \frac{17}{1875}$  or  $\frac{17}{1875}$ .

Therefore 86 Solar years answer to 87  $\frac{17}{1875}$  of the rule, and subtracting the fraction from both, we have  $95 \frac{1853}{1375}$  and 87 years, which however, must not be taken to be exactly 87 years of the Planet, as shall be shewn presently.

The fraction  $\frac{1}{18}\frac{65}{72}$  being converted into time (Table XIV, page 16) will answer, together with the years, to 85y 356p 44d 9p,6, and this is one of the periods which will serve for finding the Epoch of any other expunged year, that of any one being given.

Ist period, 85 \frac{48.5\frac{8}{48.5\frac{8}{5}}}{18.5\frac{8}{5}} or \$5 \text{356} \text{469} \text{p.6} or \$5 \text{361 \text{56} 49,206} in \$\text{Solar time.}

The other period requisite for the general resolution of the problem, is the time due to 86 of

2d period, \$5 \(\frac{5}{18}\)75 or \$5\(\frac{5}{10}\) 57d \$5\(\frac{5}{10}\) i. e. \$5\(\frac{9}{10}\) 00 58d \$6\(\frac{9}{10}\), 48332 in Solar time.

Jupiter's years, which being one less than the preceding, may be obtained by subtracting from the integer the annual increase or  $\frac{1575 - 22}{1875} = \frac{1553}{1875}$ . This quantity subtracted from the first period, viz.  $85 = \frac{1558 - 1853}{1875} = 85 = \frac{5}{1875}$ , will give the period sought; and the fraction  $\frac{5}{1875}$  answering to  $57^4$  36°, will be in Saura time 85y Op 57d 36P precisely according to the rule. (\*)

## Resolution of the Epochs.

By means of the two periods above determined, the recurrence of the expunged year may be found with precision according to the Jyautistava account.

#### EXAMPLE.

Let the given Epoch be that calculated at page 209, by means of the year Saca 572, where the fraction of the 1st member being zero, shews that the commencement of the Solar and Vrihas. pati years were simultaneous. We shall have the following series.

where the 1st period (of 87 Chacra years) has first been added to the Epoch A. S. 572, and then the 2d (of 86 C. years) added in succession so long as the fraction does not exceed unity or  $\frac{1}{13}\frac{3}{7}\frac{5}{75}$ .

In the present case the fraction amounting in A. S. 912, to  $\frac{18.73}{18.75}$  cannot evidently be increased by  $\frac{5}{18.75}$  without exceeding unity, as was the case at the preseding periods: Hence, the last resolution A. S. 912  $\frac{18.73}{18.75}$  becomes a new Epoch, to which the first equation is again to be applied; the remainder of the fraction to unity being  $\frac{2}{18.75}$ .

355n 49d 29p,95255 
$$\times$$
 86 = 85y 0r 56d 55p,91930, &c.  $\left.\right\}$  Saura time.

<sup>(\*)</sup> That these periods of Jupiter's revolutions are only true, relatively to the Rule, will appear from multiplying his year according to the Aria Siddhanta (above determined) by 86 and 87.

N. B.- In the following Examples I have preserved the Saura in preference to the Solar time, because the fraction is easily reducible to it by means of Table XIV.

For the succeeding Epochs we have, therefore,

where the period for the year Saca 998 has been found by adding  $912 \frac{18}{18} \frac{2}{75}$  to  $85 \frac{18}{18} \frac{5}{75}$  the 1st equation (page 210) =  $912 + 85 + 1 + \frac{18}{18} \frac{5}{75} = 998 \frac{18}{18} \frac{5}{75}$ , and the subsequent ones by adding  $85 \frac{1}{18} \frac{5}{75}$  for each interval to  $912 \frac{18}{18} \frac{7}{75}$ .

Here again the last fraction warns us that the series can be carried no further, the remainder to unity being  $\frac{4}{1875}$  and the periodical increase being  $\frac{5}{1875}$ . Therefore a new Epoch must again be determined by adding  $85^{9} \frac{1858}{1875}$  to  $1258 \frac{4871}{1875}$ , as we have done in the preceding case.

And thus the periods, when a Chacra year is to be expunged, may be calculated ad infinitum without the least error.

N. B.—The series of Epechs the difference of which is 86 Chacra years, and which in the two preceding Examples extend only to four, may in some cases amount to five; which circumstance depends on the fraction approaching sooner or later to unity. Thus if the foregoing periods be carried on, by the same rule, the 4th period from the last Epoch will be  $1594\frac{1869}{1875}$  and the fraction admitting of a farther increase by  $\frac{5}{1875}$  without reaching unity, the next will be  $1679\frac{1874}{1875}$ , wanting only  $\frac{1}{1875}$  from it, and therefore occasioning a new Epoch.

#### General Observations.

As it has been customary from time immemorial in Southern India, to annex the name of the Vrihaspati year to all dates expressed in Luni-solar time, and as the Jyautistava rule which is followed in some countries gives Epochs for expunged years greatly different from those of the Surriah Siddhanta, I have taken some pains to investigate the mechanical operation of the rule of the former with a view to establish the difference of their Epochs, and this will be found in Table XIX, p. 23, where the Epoch of every expunged year according to the two Styles, has been computed since the Epoch of Salivahana, beyond which the Jyautistava account does not ascend.

Concurrence of the Siddhanta and Jyautistava Chacra years.

Table XIX, page 23, shews that whereas in the year of the Cali yug 3239, or Saca 60, the Jyautistava account placed the Cshaya two years later than the Surriah Siddhanta, in the present time, on the contrary (1679 Saca) it falls 13 years earlier.

For the years of the Chacra according to the Tellingas relatively to those of the Sastra's style, see page 205, where it is shown that in the 4870th of the Cali yug the former was slower by 56

Concurrence of the Siddhanta and Tellinga Chaera years. years, the number of expunged years since the commencement of the yug, an equation unknown to the Tellingas.

On the concurrence of the Vrihaspati and Christian years.

Concurrence of the Vrihaspati and Christian years,

Lastly, with regard to the concurrence of the Christian years with those of the Chaera, although we have been compelled for the sake of arrangement to annex the numeral of the Christian year which coincides most with the Hindu Solar years, to the beginning of which the time elapsed of the Vrihaspati year is referred, yet it is sufficiently obvious from what has been stated in the first part of this article, that it may be very near ending when the former is about to commence; in which case there would be so much of the Vrihaspati year elapsed on the Christian date on which the Hindu Solar year begins (which for a long time past has been in the month of March, Julian style), that the said Chaera year would more properly be coupled with the preceding Christian year than the former.

Thus on the 1st Chaitram of the Solar year 4871 from the Cali yug current, there remained, according to the rule of the Surriah Siddhanta, only 7 days to run of the Chacra year Vicari (3624 22-3534 173)—but the said Solar year began on the 9th April 1769; therefore the greatest part of Vicari from its beginning elapsed in A. D. 1768. But the custom has always been to couple the name of the Vrihaspati year, at whatever period it may begin, with that of the Solar years from whose commencement that of the former is deduced. Now as A. D. 1769 is considered mainly to coincide with A. Cal. 4871 current (4870 ending in the said Christian year), so is Vicari, the Chacra year under consideration, coupled with 1769; and thus Mr. Davis has found that the year of Christ 1784 corresponded with Anauda and Racshasa the 48th and 49th years of the Chacra (\*); but this double notation would be attended with so much inconveniency, that I have seen it used no where.

On the Vrihaspati Cycle of twelve years.

On the Vrihaspati Cycle of 12 years. In the Cycle of sixty are contained 5 Cycles of twelve years, each supposed equal to one year of the Planet. I only mention this Cycle because I found it mentioned in some books, but I know of no nation or tribe that reckons time after that account.

The names of the five Cycles, or Yugas, are as follows:

| Names.<br>1. Sumvatsara | - | • | Presided by<br>Agni. |
|-------------------------|---|---|----------------------|
| 2. Parivatsara          | - | • | Arca.                |
| 3. Iduvatsara           | - | • | Chandra.             |
| 4. Anuvatsara           | - | - | Brahma,              |
| 5. Udravatsara          | _ | • | Siva.                |

<sup>(\*)</sup> Asiatic Researches, Vol. 111, p. 215.

7

The name of each year is determined from the Nacshatra in which Viihaspati riscs and sets heliacally; and they follow in the order of the Lunar months.

The years beginning with the month Cartie commences with the Nacshatra Critica, and to each year there appertains two Nacshatras, except the 5th, 11th, and 12th years, to each of which belongs three Nacshatras. These are arranged in the following order:

|   | Months<br>beginning years, | Nacshatras.                          | 1  | Months<br>beginning years. | Nacshatras.                               |
|---|----------------------------|--------------------------------------|----|----------------------------|-------------------------------------------|
| 1 | Cartic                     | Criticà, Rohini                      | 7  | Vaisácha                   | Visac'ha, Anurádha                        |
| 2 | <b>A</b> grahayan          | Mrigasiras, A'rdrà                   | 8  | Jyaishtá.                  | Jyést'ha, Mula                            |
| 3 | Paushia.                   | Punarvasu, Pushia                    | 9  | Ashar                      | P. A'shad'ha, Ut. A'shad'ha               |
| 4 | Mágha                      | Asleshà, Maghà                       | 10 | Srávana                    | Srávana, Dhanish'tù                       |
| 5 | P'ha'lguna                 | P. Phalguni, Ut. Phalguni, and Hasta | 11 | Bhádrapada                 | Satabhisha, P. Bhádrapada, Ut. Bhádrapada |
| 6 | Chaitra                    | Chitra, Swati                        | 12 | A'swina                    | Revati, A'swini, Bharani.                 |

It may be remarked that in the foregoing arrangement Cartic is placed the first in the Cycle of 12. It may therefore be inferred, that there was a time when the Hindu Solar year, as well as the Vrihaspati Cycle of 12, began with the Sun's entrance in, or near the Nacshatra Critica.

It follows also from this, that the first year of the Cycle of 60, begins in the Lunar month Cartic. But the Southern Indians, if they ever did, have long since ceased to attend to the months of the Chacia year,

The Tables, from the Mith (page 15) to the XIXth (page 23 of the Tables) were constructed for the purpose of abridging all the operations disclosed in the preceding pages: which, independently of their being very tedious from the constant reduction of one sort of time to another, or degrees into time, expose the computer to frequent mistakes. It is to be remembered that the Tables which refer to the Surriah Siddhanta take the Solar year to be 365p 15<sup>d</sup> 31<sup>v</sup> 31<sup>p</sup>,24 and those which refer to the Aria Siddhanta 365<sup>d</sup> 15<sup>g</sup> 31<sup>v</sup> 15<sup>p</sup>.—And furthermore, that the duration of Jupiter's year according to the former is 361<sup>d</sup> 2<sup>g</sup> 4<sup>v</sup> 44<sup>p</sup>,2 &c. and to the latter 361<sup>d</sup> 1<sup>g</sup> 21<sup>v</sup> 39<sup>p</sup>,1 &c. in mean Solar Sydereal time, as has been shewn in the course of this Memoir.

There will be found annexed to Table XVIII (page 20 and following) a variety of Examples of the application of all the rest, which supersedes the necessity of adding any thing here on the subject of these Tables. (\*)

### POSTSCRIPT.

From the preceding investigation we derive a Rule, which will be found very convenient for finding the Chacra year answering to any proposed Christian or Hindu Solar year.

Tables for computing the year of the Chaera,

<sup>(\*)</sup> The names and numerals of the years of the Chacra will be found in the General Solar Table at the ead of the volume.

#### PRECEPT.

Shoot Rule for elicining the Vranaspati year, and its rank in the Cycle of 60.

- "If the Christian year be proposed, find the corresponding one of the Call yug by adding 101 thereto, the sum will be the last year expired of the same.
- "Divide the expired years of the Califying by 86; add the quotient to the dividend; divide
- " again the sum by 60, the quotient will give the number of Cycles expired, and to the remainder,
- " if the proposed year be less than 31 from the last expunged year of the Chacra (found in Table
- " XVIII', add 28, and if it falls in the 55 remaining years of the Cycle of 86, add 27, and the
- sum will be the numeral of the year current of the Chacra.

#### EXAMPLE 1.

Let A. D. 1600, answering to A. C. 4701 complete, be proposed.

Examples.

Piecept,

By Table XVIII we find that the last expunged year fell on A. D. 1598

|                               |   | •        | .000    |
|-------------------------------|---|----------|---------|
| Year of the Cycle of 83 years | • | -        | 2       |
| 19                            |   | 20       |         |
| Then - 86)4701(51             |   | 4701     |         |
| 401                           |   | 54       |         |
| 57                            |   | 60)4755( | 79      |
|                               |   | 555      |         |
|                               |   | 15       |         |
|                               |   | 23       |         |
|                               |   | 43       | Saumya. |

Here we have added 28, because the proposed year was the second of the Cycle of 86 years.

#### EXAMPLE 2.

Let A. D. 1824, answering to the 4925th year of the Cali yug complete, he proposed.

By the Table XVIII the last expunged year of the Chacra fell on A. D. 1770
1824

| Year of the Cycle of 86 years              |                           | 54       |
|--------------------------------------------|---------------------------|----------|
| 10.                                        | 20                        |          |
| <b>8</b> 6)4925(5 <b>7</b><br>6 <b>2</b> 5 | 4925<br>57                |          |
| 23                                         | 60)4982(8 <b>3</b><br>182 |          |
|                                            | 2<br>27                   |          |
|                                            | 29 Ma                     | nmat'ha. |

Here we added 27, because the proposed year exceeded the 31st of the Cycle of 86 years.

#### EXAMPLE 3.

Let A. D. O, answering to the 3101st of the Cali yug complete, be proposed.

By Table XVIII the last expunged year of the Chacra fell on A. A. C. 36, which marks the rank of the proposed year in the Cycle of 86 years.

| 15                         | <b>2</b> ∙.       |
|----------------------------|-------------------|
| <b>8</b> 6)3101(3 <b>6</b> | 3101              |
| 521                        | 36                |
| 5                          | 60)3137,52<br>137 |
|                            | 17                |
|                            | 27                |
|                            | 41 Sadharana.     |

Here again we added only 27, because the year proposed was the 36th of the Cycle of 86 years, exceeding 31.

The reason of this operation may be explained as follows:

As the parts or fractions of years are neglected in the short Rule, the expunged years resulting from the same do not coincide with those of the Sastra rule; although both be governed by the Cycle of 86 years.

| <b>8</b> 0)4001(5 <b>6</b><br>c01 | For instance, let the Christian year 1800 answering to 4901 of the Cali     |
|-----------------------------------|-----------------------------------------------------------------------------|
| 85                                | yug complete, the remainder 85, after division by 86, shews that the quo-   |
| 4901                              | tient 56 will increase by one on the next Solar year; and therefore, that a |
| 56                                | Chacra year will be expunged.                                               |
| 60)1"57(\$2 years.                | But by Table XVIII we find that the last expunged year of the Chacra        |
| 7<br>27<br>27                     | according to the Sastra, falls on A. D. 1770 1801                           |
| 4                                 | 31                                                                          |

that is to say, 31 years before. 🛂 🕠

So that well then the results by the Sastra, preceded that of the short Rules by one year.

| <b>8</b> 0)1900 5 <b>7</b> |                                                                                       |
|----------------------------|---------------------------------------------------------------------------------------|
| 609                        | But as in 1801, or 4902 of the Cali yug complete, the quotient after division         |
| 0                          | by 86, increased by one, and as there was zero for remainder, it follows that the     |
| 490 <b>2</b><br>57         | remainder after division by 60, increased by two; and therefore, one year of the      |
| 60) 1959.82                | Chacra must be expunged; that is, the numeral in the series will be increased by      |
| 159                        | one; so that from the said year, to the end of the Cycle of 86 years (55) the results |
| 39<br>27                   | of both Rules will agree.                                                             |
|                            |                                                                                       |

Having thus found the manner of expounding quickly the year of the Chacra, from that of the Cali yug according to the precepts of the Surriah Siddhanta, we may easily deduce that which is elicited by the Jyautistava rule by a comparison of Tables XVIII and XIX.

END OF THE THIRD MEMOIR.

# FOURTH MEMOIR.

ON THE

# LUNAR YEAR

OF THE

# MAHOMMEDANS.

Written in A. D. 1814; Revised in 1823.

|  | • |   |
|--|---|---|
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  | • |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   | • |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |
|  |   |   |

#### MEMOIR

On the Lunar year of the Mahommedans and on the Era called Hejira.

On a subject so fully explored as that of the Lunar year used throughout Islaamism for the purposes of civil life, independently of all sects and geographical positions, it would be vain to pretend to offer any thing new: the occasion of this paper could therefore only arise from particular circumstances. Thus being lately engaged in a research which required the knowledge of the Christian dates concurring with those of the Hejira, and not having been able to procure any Treatise or Tables that could give me assistance, I prepared the Elements of the present Note for my own use, but without the least intention of communicating it to the public. Being lent, however, to a learned friend (\*) who, like myself, wanted access to the Mahommedan Kalendar, the original tract, (which contained only a few practical rules for finding the conjunctions on which the beginnings of the Civil years and months of the Hejira, depend) acquired in his hands a public existence for which it never was intended, and in consideration of this unexpected distinction, I was induced to give it subsequently its present form and extension: although, for reasons already stated, I forbore entering into the particulars of a theory which is familiar to every student in Chronology.

When on the revival of the sciences in Europe, the Arabs were resorted to for the embers of that hallowed fire which the Kalif Omar had extinguished, the works of Almamon (1), Alfragan (2), Thebith-Beu-Chora (3), Albategni (4), Arzachel (5), Alhazens (6), and others, drew the attention of all the votaries of science; and even afterward, when its light began to dawn again on the West of Europe, the works of Ulug-Beg (7) proved a further and fertile source of information. It is universally admitted, that we owe to that successful appeal to the labours of the Arabian Astronomers, some of the most ingenious discoveries in modern Astronomy: but to reap this harvest, it was indispensable to find means for reducing the observations which they had recorded according to their particular account of time, to the concurrent dates of the Christian Kalendar, and that work, which was not without considerable difficulties, was performed by the most celeabrated Mathematicians of successive ages. Melancton, Christman, Bianchini, Snellius, Gravius, F. Peteau, F. Riccioli, Wolfius and others, have left nothing to add to their researches. (†) What follows, is a short abstract of their labours.

A. D. 1300.

<sup>(1)</sup> Son to Aar mal-Rashid, ascended the throne A. D. 814.

<sup>(2) 500.</sup> (3) 550.

<sup>(1) 350.</sup> 

<sup>(5) 1930,</sup> (6) 1130, (7) 1439,

<sup>(\*)</sup> The late Mr. Ellis.

<sup>(†)</sup> Vide Gravuts in commentary on Ulug-Beg; Christman on Alfragan; F. Peteau in his 7th Book " De Doctrina Temporam;" F. Riccioli's Refermed Caronology; and the Elements of Mathematics of Wolding.

Common Epoch of Hepra 16.1 July 622.

By most Arabian Astronomers 15th July same year.

Pooch referred to other accounts of time.

Common Lurar Synedicid year of the Arabs,

The Lunar year, month and day, hegias immediately after Sun set.

Cycles of thirty years,

The years of 12 Luniu monds, and the months alternately of 30 and 12 days.
The last month consists of 30 days in the intervalury years.

Every one knows that the Epoch of Hejira, or flight of Mahommed from Mocha to Medina, from which all Meslems reckon their Civil year, was found to concur with Friday, the 16th July, A. D. C22.—A certain sect of Islaamites, however, (of which were most of their Astronomers) reckoned it from the preceding day; i. e. Thursday, the 15th of July of the same year; a circumstance not to be forgotten when reading their ancient authors. (\*)

It was established that the first year of the Æra was the 5335th of the Julian period;—Solar Cycle 23—Lunar Cycle 15—Cycle of Indiction 10—and of the Æra of Nabonassaar (the current year of which began on the 21st March preceding) the 1370th.

The Lunar year was found to consist of 354 days, 8° 48′ 36″, and the Lunar Synodical month of 29 days, 12° 44′ 3″. So that the Mahommedan year falls short of the Julian by 10 days, 21° 11′ 24″ (nearly 11 days); from which it follows that 12 Julian years are equal to 12 years, 130 days, 14° 16′ 48″ Mahommedan reckoning; and 12 Tropical years are equal to 12 years, 130 days, 12° 1′ 48″ of the same.

With these data there was no difficulty for finding the concurring Astronomical periods of both styles: but this would not have been sufficient for understanding the Arabian authors, who had recorded their observations according to the Civil Kalendar used in their own time and country. And as the Arabs had made their Civil day, month and year, begin in the evening immediately after Sun set, on the day after the conjunction, when the Moon's crescent began to be visible, it was found necessary to analyze the system on which their Kalendar had been established, and to understand how the mode of assigning the unequal duration of the Civil months, and of intercalating the Civil years, which they had adopted, made each so to keep pace with the Moon's Synodical revolutions, that the beginning of every month always followed the conjunction by the least time necessary for the Moon to become again visible. This was the part of the problem which tried the skill of the European Astronomers: but with which we have at present nothing to do; what follows, being perfectly sufficient for all practical purposes.

The Arabs divide time into Cycles of 30 years, 19 of which are called common, and consist of 354 days, and 11 are called interculary, which are of 355 days. The latter, in the order of the Kalendar, are the 2d; 5th; 7th; 10th; 13th; 16th; 18th; 21st; 24th; 26th and 29th of the Cycle.

The year of Hejira is divided into 12 Kalendar months, which consist alternately of 30 and 29 days; excepting the last month, which in the intercalary years consists of 30 days.

The months are also composed of four weeks, and 1 or 2 days, which differ in nothing from ours.

The names of the months are as follows:

|   |                          | Days. |    |                                | Days.          |
|---|--------------------------|-------|----|--------------------------------|----------------|
| 1 | Mahorum                  | 30    | 8  | Shahaban                       | 29             |
| 2 | Suffr, or Sephe <b>r</b> | 29    | 9  | Rhamadan; or }                 | 30             |
| 3 | Rabi-el-Avul             | 30    |    | •                              | 1              |
| 4 | Rabi-el-Aukeer, or Sanee | 29    | 10 | Shawal                         | 29             |
| 5 | Giumadi; or } el-Avul    | 30    | 11 | Zoolcada; or;<br>Zoolcayadah { | 30             |
| 6 | Giumadi; or el-Aukeer    | 29    | 12 | Zooledgee; or Zoolcagiadah     | 29<br>or<br>30 |
| 7 | Regeb, or Regihab        | 30    |    |                                |                |

which last month in intercalary years counts 30 days.

The names of the days of the week are,

|   | Indian Names. |   | Arabic Names.   |           |
|---|---------------|---|-----------------|-----------|
| ١ | Etwar         | 1 | Yoom-el-Ahad    | Sunday    |
| - | Peer          | 2 | Yoom-el-Thani   | Monday    |
|   | Mungul        | 3 | Yoom.el.Thaleth | Tuesday   |
|   | Char Shumbol  | 4 | Yoom_el-Arbaa   | Wednesday |
|   | Jummah Rhaut  | 5 | Yoom_el-Kamis   | Thursday  |
| 1 | Jummah        | 6 | Yoom-el-Dgiooma | Friday    |
|   | Avul Hastah   | 7 | Yoom_el_Effabt  | Saturday  |

The Arabic names of the days of the week are numerals; first, second, third, &c.

Arabian Astronomers call the weekly day or feria by which the year or month commences, the Character or Root of the said year or month; so that in the Mahommedan Kalendar each year and month has its peculiar Root or Character, which serves to find their succession, as shall be explained hereafter.

Roots of years and months, the day of the week on which each begins,

Thus much it was necessary to disclose of the construction of the Mahommedan Kalendar to render the third General Table, and those numbered L and LI, intelligible. The process for determining the root, and initial feria of every month and year (to begin from the evening of the 16th July A. D. 622, and continue to any subsequent month and year) is fully explained at page 221 of this Memoir.

EXPLANATION and use of the Tables which refer to the Mahommedan Year.

Of the General Table III of this collection, being the 1st for this Memoir.

This Table gives the beginning of every year of the Hejira from A. H. 1 to 1318, and the Christian concurrent years from A. D. 622 to 1900, according to the Gregorian and Julian styles. It differs from other Tables of the same kind (of which there are several) only in the arrangement of the years, which are here disposed according to their respective roots, or initial ferix; the

Disposition of the General Table III.

figures 1, 2, 3, 4, 5, 6, and 7 in the transverse column at top, indicating that all the years registered under each respectively, begin on a Monday, Tuesday, &c. which roots are indispensable for finding the commencement of the 11 last months of the year. I have preferred this arrangement to the more natural one of following the series of numbers, from local circumstances; and because it facilitates a reference to the beginning of Hindu years of all styles, which like those of the Hejira, are elicited by their initial feriæ: so that in many cases their beginnings may be compared or verified by mere inspection. The inconveniency resulting from the interruption of the series, which retards a little the finding of the year sought, is more than compensated by the advantage of avoiding the possibility of mistaking the roots; for the initial feria is known the instant the year is found.

B indicates an intercalary year. The letter B affixed to any particular year of Hejira, indicates that it is one of the eleven intercalaries of the Cycle of 30 years, and that it consists of 355 days.

\* that the year is the last of the Cycle of 30 years, The asterisk \* and stroke = above and below the same year, indicates that it is the last of the Cycle of 30 years, and that the intercalations begin anew from that period, according to their permanent order.

Concurring years of the Cali yug and Saca how noticed.

Each page contains a century of Christian years, and its number is indicated at the top of it. In the margin on each side is entered the first and last concurring years of the Hejira; of the Æra Cali yugam, and from the birth of Salivahana, usually called Saca.

In those particular cases where the Mahommedan year begins and ends in the same Christian year (or, which is the same thing, when two years of the Hejira begin in the same Christian year), the commencement of both is inserted in the column of the root proper to one of the said two years; so that the other is out of its place; on which account its own character is affixed to it, and these years are repeated twice in the same page. Thus we find A. D. 1258 in the first and third column of the page containing the 13th century, because the roots of A. Hejira 656 and 657 are 3 and 1, and that the beginning of both fell in the said year of Christ 1258. I have preferred repeating, to separating these years; because the former method gives a warning which may prevent troublesome mistakes.

From the year 1582, when the Gregorian style was introduced on the Continent of Europe, the notation is registered according to both styles, which was found necessary, because the new one only obtained in England in the years 1752. What remained of years to reach the end of the 19th century, was not of sufficient consequence to alter again the form of the Table. The commencements of the years of the Hejira continue therefore to be given till the end, according to old and new style.

#### EXAMPLE I.

Thus if I want the Christian year concurring with that of the Hejira 271, I look into that page of the General Table III, where 184 (the nearest below that year at the top of any page) is registered

How to find the Christian year corresponding with any of the Hejira by Table III. in the margin; and finding that it falls in the 9th century and in the column, the root of which is 2, I conclude that it concurs with A. D. 881; that the 1st Mahorum of that year fell on Yoom-el-Thani (Monday) the 29th June O.S.; and lastly, as the notation of the Mahommedan year bears no B, that its last month Zooledgee, consists only of 29 days, the year being a common one.

EXAMPLE II.

But if the Christian year 1824 be proposed, and the beginning of the concurrent Mahommedan year be wanted, referring to the same Table where the 19th century is indicated, I find the given year to concur with A. H. 1240, under the root 5, which shews that it begins on a Thursday (Yoom-el-Kamis), and as its notation bears a B, it is a sign that the year is an intercalary one, and therefore, that the last month, Zooledgee, consists of 30 days.

How to find the year of Hejira corresponding to any Christiau year by the same Table.

For finding the beginning of the intermediate months of the Mahommedan year, by help of the General Table III, it is supposed that the Dominical Letter is known. But although it be not expressed on its face, it may quickly be deduced from the European date and character which indicates the commencement of the year of Hejira.

#### EXAMPLE III.

For as we have found that the year of Hejira 1240 will begin on the 14th of August Julian and 26th Gregorian styles A. D. 1824, and as the root for that Mahommedan year was 5 (Yoom-el-Kamis, or Thursday), on referring to any Kalendar wherein the Dominical Letters are inserted, and taking the 14th August to fall on a Thursday, we find, (counting three days therefrom) that the Sunday following corresponds to the Letter E, which is therefore the second Dominical Letter of that Bissextile year, and F the first according to the Julian style.

How to find the Dominical Letter by means of the General Table III.

In the same manner the 26th August falling on a Thursday, the Letter opposite to the next Sunday will be found to be C, the second, and D the first Dominical Letter according to the Gregorian style.

But as it seldom happens that the beginning and end of the same year of the Hejira falls during the course of the Christian year in which it begins, the Dominical Letter of the ensuing one is almost always required: but it is sufficiently known to be the preceding one in the order of the alphabet to that previously found.

## Of TABLE L, being the second for this Memoir.

As the General Table III only gives the root of the year and Mahorum, it was necessary to establish some means for obtaining that of the remaining months of any proposed year, from which the particular dates might be deduced.

For this purpose a Table was constructed by Gravius on the following principle.

As the twelve months of the Lunar year are alternately of 30 and 29 days, the latter begin and end on the same weekly day or feria; and the former end on the next to that on which they began.

Construction of Table L.

Its use.

Thus when the month of Mahorum, which consists of 20 days, begins on the first feria (Sunday) it ends on the 2d (Monday); Suffr, which comes next, has only 29 days, and therefore begins and ends on the 3d feria (Tuesday); Rabi-el-Avul, having 30 days, begins on the 4th feria (Wednesday) and ends on the 5th (Thursday); and so on of the rest.

Attention to the duration of Zo dedgee when the year is intercalary.

The only particular attention required in this process, is to notice whether the year be a common or an intercalary one; because (as has been explained at page 220) in the latter case Zooledgee counting 30 days, ands on the feria next to that on which it began, whereas in common years it ends on the same.

#### EKAMPLE.

How to find the hegioning of every monta in the Lunar year. Let it be required to find the beginning of every month in the year of Hejira 1240.

Referring to the General Table III, where A. H. 1216 stands at top in the margin, with 1240, we find that this year falls in the 19th century, and in the column whose root is 5, which shews that it will begin on a Thursday (Yoom-el-Kamis). The letter B, annexed to its notation, indicates also that it is an intercalary year, consisting of 355 days; and therefore, that the month of Zooledgee counts 30 days.

Again, since the same Table informs us that the proposed year begins on Thursday the 14th August 1824, Julian style, if we follow the process indicated at page 223, we find that the Dominical Letters for that Bissextile year are FE; and for 1825 D, Julian style, or DC for 1824 and B for 1825 Gregorian style.

With these data we are to proceed as follows:

The character of the proposed year being 5 (Thursday), we turn to the column in Table L, the initial feria of which is 5 at top; and in which we are to continue for the remainder of the year of Hejira 1240.

#### 2. For the month of Suffr.

The root of this month, Table L, is 7; i. e. Yoom-el-Effabt (Saturday).

To check this, if we count 30 days in the Kalendar from 14th August, we find 13th September; which truly falls on a Saturday.

#### 3. Rabi-el-Avul.

Root 1, i. e. Yoom.el-Ahad, Sunday; count 29 days from 13th September, and we have 12th October, which also falls on a Sunday.

#### 4. Rabi-el-Aukeer.

Root 3, i. e. Yoom-el-Thaleth, Tuesday; count 30 days from 12th October, and we have 11th November, and it also falls on a Tuesday.

#### 5. Giumadi-el-Avul.

Root 4, i. e. Yoom.el-Arbaa, Wednesday; count 29 days from 11th November, and we have 10th December, Wednesday.

#### 6. Giumadi-el-Aukeer.

Root 6, i. e. Yoom-el-Dgiooma, Friday; count 30 days from 10th December, and observe that: the Dominical Letter for 1825 becomes D, Julian style; and we have 9th January 1825, Friday.

#### 7. Regeb.

Root 7, i. e. Yoom-el-Effabt, Saturday; count 29 days from 9th January, and we have February. 7th, Saturday.

#### 8. Shahaban.

Root 2, i. e. Yoom-el-Thani, Monday; count 30 days from 7th February, and we have 9th March, Monday.

#### 9. Ramazan.

Root 3, i. e. Yoom-el-Thaleth, Tuesday; count 29 days from 9th March, and we have 7th: April, Tuesday.

#### 10. Shawal.

Root 5, i. e. Yoom.el-Kamis, Thursday; count 30 days from 7th April, and we have 7th May, Thursday.

#### 11. Zoolcade.

Root 6, i. e. Yoom.el.Dgiooma, Friday; count 29 days from the 7th May, and we have 5th of June, Friday.

#### 12. Zooledgee or Zoolcagiadah.

Root 1, i. e. Yoom-el-Ahad, Sunday; count 30 days from 5th June, and we have 5th July, Sunday.

If we wish further to check this operation, say,

To the 5th of July add 30 days (because the year of the Hejira 1240 is an intercalary one, and Zooledge has therefore 30 days) and you have 4th August, which by the Julian Kalendar falls on a Tuesday, and therefore 3 should be the character for the ensuing Mahommedan year 1241. Referring to Table I, we find in fact that the said year began on the 4th of August, Julian style, and that it bears 3 for root; therefore, the operation has been well performed.

For having the concurrent beginnings according to the Gregorian Kalendar, the process is exactly the same, excepting that a different Dominical Letter must, be used.

Thus employing DC, and B, instead of the former Letters, we shall have,

| 1  | Mahorum A. H. 1240                    | Yoom-el-Kamis          | Thursday           | 26th August.          |
|----|---------------------------------------|------------------------|--------------------|-----------------------|
| 2  | Suffr                                 | Yoom.el-Effabt         | . Satur ay         | 25th September.       |
| 3  | Rabi-el-Avul                          | Yoom-el-Ahad           | Sanda $\mathbf{y}$ | 24th October.         |
| 4  | Rabitel-Aukeer                        | Yoom-el-? haleth       | Tresday            | 23d November.         |
| 5  | Giumadi-el-Avul                       | Yoom-el-Aibaa          | Wednesday          | 22d Decembe <b>r.</b> |
| 6  | Giumadi-el-Aukecr                     | Yoom-el-Dgiooma        | Friday             | 21st January.         |
| 7  | Regeb                                 | Yoom-el-Effabt         | Saturday           | 19th February.        |
| 8  | Shahaban                              | Yoom-cl-Thani          | Monday             | 21st March.           |
| 9  | Ramaz <b>an</b>                       | Yoom-el-Thaleth        | Tuesday            | 19th April.           |
| 10 | Shawal                                | Yoom-el-Kamis          | Thursday           | 19th May.             |
| 11 | Zoolcade                              | Yoom-el-Dgiooma        | Friday             | 17th June.            |
| 12 | $oldsymbol{Z}$ ooledge $oldsymbol{e}$ | Yoom_el_Ahad           | Sunday             | 17th July.            |
| 1  | Mahorum A. II. 1241                   | and<br>Yoom-el-Thaleth | Tuesday            | 16th August.          |

Thus it was that beginning from the 16th July A. D. 622, of which the corresponding year of the Hejira was 1 commencing, and whose root was 6 (Yoom-el-Dgiooma or Friday), the whole of the General Table III was constructed. It is easy to perceive how that Table may be prolonged at pleasure, to any assignable Epoch whatever.

There remains now only to shew, how to deduce any particular date when the commencement of the months and year have been determined.

How to expound any particular date,

This question presents no sort of difficulty; for let Yoom-el-Thani, the 18th of Shawal, A. Hejira 1240, be proposed.

Having found in the preceding article, that the said month will begin on the 19th May N. S. 1824, add 18 days to that date, and you have Monday, the 6th of June at Sun set, Gregorian style.

In the same manner, let the 15th of January 1825 O. S. be proposed, and its concurrent date in the Mahommedan Kalendar be wanted.

Having found in the preceding article, that the 1st Giumadi-el-Aukeer will fall on Friday, the 9th of January O. S. 1825, subtract the same from 15; and the remainder 6, shews that the proposed date will fall on Yoom-el-Kamis, the 6th of Giumadi-el-Aukeer.

# Of TABLE LI, being the third of this Memoir.

How to find the Hirdu Solar year current on the beginming of any year of the Hejira. This Table serves to find by approximation the Hindu Solar year current on the beginning of any proposed year of the Hejira, so that their juxta position may always be determined, excepting in a very few cases, which are so clearly indicated that there is no mistaking them (as will be seen hereafter): but to compare any particular date, recourse must be had to the means which were disclosed in the Memoir on the Hindu Solar year, because the present Tables give only the

commencements of Hindu years concurrent with Christian Secular years, which mark the limits of the intermediate years of any century in the scope of three days Julian and four days Gregorian styles.

The first division of Table LI exhibits the years of the Hejira, with their beginnings according to European expression, concurrent with Christian Secular years from A. D. 622 to 1960.

The second division gives the Hindu Solar years Cali yugam and Saca, with their common beginning, according to European expression, and to the Julian or Gregorian Kalendar, both referred to the same Christian Secular years, which are expressed in the last column on the right.

Now let it be proposed to determine by inspection what Solar year of the Cali yug or Saca, commences or ends in the year of the Hejira 562?

10 Refer to the General Table III in that page which has A. Hejira 495 at top in the margin; you find that 562 falls in the 12th century, on the Christian year 1166 Julian style, and that it begins on the 28th October of that year.

20 To 1166 add 3102; you have 4268 the notation of the year Cali yugam current, and from 4268 subtract 3179, you have 1089 that of the year Saca, or from the birth of Salivahana.

Now reverting to Table LI we find (sec. 2) that the Hindu Solar year concurring with A. D. 1100 began on the 23d of March of that year; and that the Hindu year which concurs with A. D. 1200, began on the 24th of the same month: therefore (preceding article) the year of the Cali yug 4238, concurrent with A. D. 1166, cannot have begun before the 22d, or after the 25th of March of that year; and as the General Table III gave the commencement of the proposed year of the Hejira on the 28th October following, it is manifest that it fell in A. Cal. 4268, and Saca 1089, and therefore, that these Hindu Solar years commenced in Anno Hejira 561.

In the present case, as the year of the Hejira proposed, began so late in the Christian year as the 25th October, and as the Hindu Solar years from A. D. 0 to 1900 commence somewhere in all the month of March, Julian style, there was no danger of mistaking the notation of the corresponding Solar years of the Cali yug and Saca.

But if instead of A. II. 562, which we have expounded, A. II. 1035 had been proposed, then extracting its notation and beginning according to European expression, out of the General Table III, we find it to concur with A. D. 1674, and to fall on the 28th March, Julian, and 7th April, Gregorian styles.

Now Table II shews that the Solar Hindu year which concurs with A. D. 1600, began on the 27th March, Julian, and 6th April, Gregorian styles. And that the Hindu year concurrent with A. D. 1700 began on the 28th March O. S. and 8th April N. S. Therefore, the Hindu year may have commenced either on the same day, or two days before, or two days after the proposed year of the Hejira; so that its notation, viz. whether it should be 4817 or 4816 Cali yugam, remains

An irreducible case by the Tables, doubtful. This case is therefore irresoluble by the present Tables alone, and recourse must be had to the Hindu rule for determining the beginning of the particular Solar year proposed.

But these occasions are so rare, that between A. D. 1500 and 1900 they occur only four times, and in order to render every resolution possible by help of the present paper, I have calculated the commencement of the Solar years of the Cali yug 4711, 4776, 4841 and 4906, on which the irresoluble case recurs, which, according to European expression, are as follows:

| Hindu years. |       | Chris-<br>tian<br>years. |            | Years of the I | Beginning of concurrent Hindu Solar years. |            |            |  |
|--------------|-------|--------------------------|------------|----------------|--------------------------------------------|------------|------------|--|
| Cali yug.    | Saca. |                          | Old Style. |                | New Style.                                 | O. S.      | N. S.      |  |
| 4711         | 1532  | 1609                     | 1018       | 27th March     | 6th April                                  | 28th March | 7th April  |  |
| 4776         | 1597  | 1674                     | 1055       | 28th March     | 7th April                                  | 29th March | 8th April  |  |
| 4841         | 1668  | 1739                     | 1152       | 30th March     | 10th April                                 | 29th March | 9th April  |  |
| 4906         | 1727  | 1804                     | 1219       | 31st March     | 12th April                                 | 29th March | 10th April |  |

It will easily be concluded from this Table, that the 1st Chaitram A. Cali yug 4711, falls on the 2d Mahorum A. Hejira 1018.

1st Chaitram A. Cali yug 4776-2d Mahorum A. Hejira 1055.

1st Chaitram A. Cali yug 4841-29th Zooledgee A. Hejira 1151.

1st Chaitram A. Cali yug 4906—28th Zooledgee A. Hejira 1218.

The converse of this proposition is still of easier solution; for suppose that the year of the Cali yeg 4040, or 1761 Saca, be proposed, and that it was found to begin on the 11th April A. D. 1833 N. S.

Then referring to the General Table III we find at once that its commencement fell on A. Hejira 1254, the beginning of which occurred on the 27th March N. S. But as that Mahommedan year lasts only until the 11th April following, it is manifest that the commencement of A. Hejira 1255 will also fall in the same year Cali yugam 4940; but that from the 6th Mahorum the year of the Hejira 1255 will concur with A. Cali yug 4911, and Saca 1762.

It will be observed, that the irreducible case adverted to in the preceding article, does not exist on this side of the question; for as the feria beginning the Hindu Solar year, and its date according to European expression, are supposed to be given by the proposition, the General Table III shews at once whether that date falls before, or after the commencement of the concurrent year of the Hejira.

Given the years of the Cali vug or Saca, how to find that of the Hejira,



## NOTE I.

On the juxta position of the beginnings of the Mahommedan Lunar and Hindu Luni-solar years.

Ir the Chandra mana had not been subjected to intercalations which have no analogy to those which are used in the Arabian Kalendar, there would have been no difficulty in comparing dates proposed in these two accounts of time, the difference of their periods being so very trifling, that for a great number of years it might have been neglected without inconveniency. Here follows a comparative view of the respective Lunar years and months on which the operation would depend.

Mahommedan and Hindu Luni-solar periods compared.

|                     |          |        |               | of 60 g |    | ias ti |     | la <b>y.</b> | European time in hours. |    |    |    |      |
|---------------------|----------|--------|---------------|---------|----|--------|-----|--------------|-------------------------|----|----|----|------|
|                     |          |        |               | ъ.      | G. | v.     | P.  | s.           | D.                      | н. | ,  |    | #    |
| Hindu Lunar         | year (Si | arriah | Siddhanta)    | 354     | 22 | 1      | 23  | 5 <b>7</b>   | 354                     | 8  | 48 | 33 | 34,8 |
| Arabic              | •        | •.     | •             | 354     | 22 | 1      | 30  | 0            | 354                     | 8  | 48 | 36 | 0,0  |
|                     |          | Diffe  | rence, Arabi  | c       | +  |        | 6   | 3            |                         |    |    | 2  | 25,2 |
| Hindu Lunar 1       | month    | do.    | -             | 29      | 31 | 50     | 6   | 59           | 29                      | 12 | 44 | 2  | 47.6 |
| Arabic -            |          | -      | -             | 29      | 31 | 50     | 7   | 30           | <b>2</b> 9              | 12 | 44 | 3  | 0,0  |
|                     |          | Diff   | ference, Aral | oic     | +  |        |     | 31           | -                       |    |    |    | 12,4 |
| Thus whilst the Ara | ibian Sy | modic  | al Cycle of 3 | O years | co | nsist  | 5 o | (*)          | 10631                   | 0  | 18 | 0  | 0    |
| The same number o   |          |        |               | •       | -  |        | -   |              | 10631                   | 0  | 16 | 47 | 24   |
| The differ          | ence be  | ing in | 30 years      | -       |    |        | _   |              |                         |    | 1  | 12 | 35   |

But although the Hindus really add or retrench nothing in their computations of Astronomical periods, yet as the construction of their Civil Kalendar requires every two or three years the intercalation of the name of a month, whilst time follows its regular course, and as the Arabsonly intercalate days, all that can be done is, after computation of the same, to compare the Prathana Tidhis which begin each Lunar month and year, with the dates of the Civil beginnings of some Mahommedan month which fall nearest to them and which never differs more than a couple of days therefrom, but which will not recur as to names in a similar series, for reasons which it is unnecessary to repeat in this Memoir.

The beginnings of the Mahoram dan and Hindu Lant-solar months may be compared without any reference to names.

| <b>(*</b> ) | The | Civil | Arabic | Cycle | is thus | constructed. |
|-------------|-----|-------|--------|-------|---------|--------------|
|-------------|-----|-------|--------|-------|---------|--------------|

<sup>19</sup> years of 354 days - - 6736d 11 years of 355 days - - 3905

Number of complete days . 10631

As for referring the Hindu Tidhis, or Luni-solar days of the Hindu year, to those of the Mahommedan Kalendar, it would be vain to attempt it by any mechanical process; a Tidhi being the space of time which is requisite for the Moon to move through 12° of her path, to or from the Sun, and consequently beginning at no fixed instant of the day or night.

Computation of the conjunction which preceded the beginning of the Æra of Hejira, by the Vakiam, or Solar process.

Computation of the juxta position of the beginning of the first year of the Hejira, and of the month Bradrapada of the Luni-solar year 3724 of the Callyug.

We have seen at Example V, page 38, of the Key to the Madhyama Saura mana, that the first Civil day of the Hejira, according to vulgar account, viz. 16th July A. D. 622, fell on Friday the 26th Audi of the 3724th year of the Cali yug: but that Hindu Solar date was deduced from the European one, and not computed on the principles of Indian Astronomy, which we shall do in the present Note; and as independently of its peculiar interest, it presents a case where the Ahargana is less than a Vedam or 1600984 days, (hitherto not considered), I shall insert it at full length for the reader's information. The computation will be referred to the supposed Meridian of Trivallore.

The Aharganas resolved in the usual manner, or by Tables XLVIII and XLIX, will be

|                                                | Sola            | r.                    |    |            |                                          | L                                  | unar.                 |    |
|------------------------------------------------|-----------------|-----------------------|----|------------|------------------------------------------|------------------------------------|-----------------------|----|
| 1st Chaitram 3724 add 3 Solar months, Tab. XLV | 1359855         | <b>G.</b><br>55<br>56 | 12 | 30         | 30th Phalguna 3723 add 4 Lunations, Tab. | p.<br>- 1359854<br>XLIX, 118       | 6. v.<br>2 41<br>7 20 | 51 |
| 1st Audi                                       | 1359949<br>+ 24 |                       | 34 | 33         |                                          | 1359972[<br>+ 1                    | 10 2                  | 3  |
| 25th Audi commencing                           |                 | 51<br>60              |    | 3 <b>3</b> | Janar Abargana -<br>Solar Ahargana -     | 135997 <b>3</b><br>135991 <b>9</b> |                       |    |
| or 24th when the time wanting                  |                 | -8                    | 25 | 27         |                                          | 24                                 |                       |    |

Dividing the respective Aharganas by 7, the Soota dinas will be, The Sun, Thursday; The Moon, Wednesday; and the Dominical Letter being expounded by Tables V and VI, is C, giving Wednesday the 14th and Thursday the 15th July 622.

For finding the Moon's place we are therefore to compute her Druva, Chandra Vakiam, Dhurmavanham, and P'hala, by her Ahargana above found, which being only 1359973, shews that it bears not division by a Vedum.

| Vedam 160     | n.<br>00984)135997 <i>3</i> (0 | 5                     | 5  | •  | ,    | •            |     |    | s | • | ,         | *  |
|---------------|--------------------------------|-----------------------|----|----|------|--------------|-----|----|---|---|-----------|----|
| Dog Charter   | 12372)1359973(109              | 109 × 3               | 3  | 27 | 43   | 10           | -   | _  | 2 | 0 | 30        | 10 |
| Maz. Gnerica. | 12372)1339973(103              | $3 \times 1$          |    |    |      |              |     |    |   |   |           |    |
|               | 122773                         | 9 🗙 (                 |    |    |      |              |     |    |   |   |           |    |
|               | 111348                         |                       |    |    |      |              |     |    | _ |   |           |    |
| Calanilam.    | 3031)11425(3                   |                       |    |    |      |              |     | _  |   |   |           | 13 |
|               | 9093                           | Equation of Vakiam 10 | 0, | T  | able | e <b>X</b> 2 | XV. | I, | 8 | 1 | 17        | 0  |
| Devaram       | 248)2332(9                     | •                     |    |    |      |              |     |    | - |   |           |    |
|               | 2232                           | ys place uncorrected  |    | -  |      | -            | -   |    | 4 | 3 | <b>57</b> | 13 |
| Chandra Vak   | iam 100                        |                       |    |    |      |              |     |    |   |   |           |    |

| Completed  To which add for 24 days,  And as on his entrance into the new Sign there wanted of Sun rising  8' 25' 27', add the guddias as calas and viguddias as vicalas  O's Saura place on the 25th at Sun rise  And his Equation by the Yoghiadi Table (XXVII, part 1) being  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract  O's Sputa Graha or true place, 25th Audi  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:     | place, compute that of the Sun at his rising on the same day, |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| Completed  To which add for 24 days,  And as on his entrance into the new Sign there wanted of Sun rising  S' 25' 27', add the guddias as calas and viguddias as vicalas  O's Saura place on the 25th at Sun rise  And his Equation by the Yoghiadi Table (XXVII, part 1) being  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract  O's Sputa Graha or true place, 25th Audi  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:     | •                                                             |
| To which add for 24 days,  And as on his entrance into the new Sign there wanted of Sun rising  8' 25' 27', add the guddias as calas and viguddias as vicalas  O's Saura place on the 25th at Sun rise  And his Equation by the Yoghiadi Table (XXVII, part 1) being  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract  O's Sputa Giaha or true place, 25th Audi  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                | he Sign Carcata S the 4th of the Zodiac. He had therefore     |
| And as on his entrance into the new Sign there wanted of Sun rising  8' 25' 27', add the guddias as calas and viguddias as vicalas - + 8 25  O's Saura place on the 25th at Sun rise - 3 24 8 25  And his Equation by the Yoghiadi Table (XXVII, part 1) being —  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract 1 9 22  O's Sputa Giaha or true place, 25th Audi - 3 22 59 3  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows: | _ 3' 0' 0' 0'                                                 |
| 8' 25' 27', add the guddias as calas and viguddias as vicalas  O's Saura place on the 25th at Sun rise  And his Equation by the Yoghiadi Table (XXVII, part 1) being  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract  O's Sputa Giaha or true place, 25th Audi  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                | + 24 0 0                                                      |
| O's Saura place on the 25th at Sun rise - 3 24 8 25  And his Equation by the Yoghiadi Table (XXVII, part 1) being —  (22' + 23' + 24') for 24 days complete, and 22" for 3 25', we have 1'  9' + 22", which subtract 1 9 22  O's Sputa Giaha or true place, 25th Audi - 3 22 59 3  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                               | w Sign there wanted of Sun rising                             |
| And his Equation by the Yoghiadi Table (XXVII, part 1) being —  (22' + 23' + 24') for 24 days complete, and 22" for 3' 25', we have 1'  9' + 22", which subtract — — — 1 9 22  O's Sputa Giaha or true place, 25th Audi — 3 22 59 3  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                             | ılas and viguddias as vicalas - + 8 25                        |
| (22' + 23' + 24') for 24 days complete, and 22" for 3° 25°, we have 1° 9' + 22", which subtract                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 5th at Sun rise 3 24 8 25                                     |
| 9' + 22", which subtract  O's Sputa Giaha or true place, 25th Audi  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                                                                                                                                                                                              | Table (XXVII, part 1) being -                                 |
| O's Sputa Giaha or true place, 25th Audi - 3 22 59 3  For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                                                                                                                                                                                                            |                                                               |
| For the Moon's place corrected.  Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 9 22                                                        |
| Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | true place, 25th Audi - 3 22 59 3                             |
| Having found the Sun's true place, we may now correct that of the Moon, as follows:                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                               |
| s. * / #                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | the Moon's place corrected.                                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | we may now correct that of the Moon, as follows:              |
| N 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <u> </u>                                                      |
| By Table XLVII, we find the Desentara calus for the preceding                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | Desentara calus for the preceding                             |
| •                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | •                                                             |
| For the andra vicalas (same Table) we find + 2, and the odd degrees,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | - · ·                                                         |
| minutes and seconds of the O's apparent Longitude being 22° 59' 3"                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | rent Longitude being 22° 59′ 3"                               |
| Multiply by × 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                               |
| The 1st Equation will be 45" 58" 6"" or say - 46                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | • •                                                           |
| For the 2d Equation. As the Moon is more advanced than the Sun,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                                                               |
| from Table XXVI take her true motion for Chandra Vakiam 100, 844'                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | ·                                                             |
| And her mean motion being 791                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                               |
| Difference 53                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                               |
| Now after division of the Ahargana by the three last Elements there                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |                                                               |
| were, among the rest, 9 Devarams, to each of which are due 32", which                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                               |
| gives $9 \times 32'' = 4'' \cdot 48''$ , to which multiplying by the difference 53' gives 4'                                                                                                                                                                                                                                                                                                                                                                                                                                                          | · · · · · ·                                                   |
| 14' 24", which because the D's true is greater than her mean motion, add + 4 14                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | greater than her mean motion, add + 4 14                      |
| D's Sputa Graha, or apparent place, 25th Audi at Sun rise - 4 4 9 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | e, 25th Audi at Sun rise - 4 4 9 13                           |
| ⊙'s do do. present page 3 22 59 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ent page 3 22 59 25                                           |
| o and )'s apparent distance at do. 11 9 48                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | it distance at do. 11 9 48                                    |

#### For the Sun's true motion.

By the Yoghiadi Table (XXVII, part 1) the Equation of the Sun's motion for 8 days to come

on the 24th Audi complete, is 
$$-22 =$$
 therefore for that day it is  $-\frac{22'}{8} = -2' \cdot 45''$ 

Which subtracted from - - 60

Gives the ©'s Sputa Gati, or true motion sought - 57 15

For the relative motion.

D's Sputa Gati - - 844' 0'

©'s do. do. - - 57 15

Relative motion - - 786 45 - 13° 6' 45''

For time due to distance.

13° 6′ 45": 60° (one day) :: 11° 9′ 48": 51° 4° 51°.

And because at the time of Sun rising on the 25th Audi, the Moon's apparent Longitude, was greater than that of the Sun, it shows that the conjunction was past, therefore subtracting the

The preceding result (through only an approximation) is perfectly sufficient for our present purposes, and shews that according to the Rules of Indian Astronomy, the conjunction which preceded the 1st Civil day of the Hejira fell some time in the morning of the 24th Audi A. Cal. 3724, and therefore the *Prathama* Tidhi of the Lunar month *Bhádrapada*, on the 25th, answering to Thursday the 15th July A. D. 622, which is precisely the day referred to by most Arabian Astronomers as that which begins the Hejira.

This coincidence may give rise to some speculations respecting the authority which was originally consulted when the Epoch of the Flight was determined. For at the time when the prophet unfurled the standard of the faith, the Arabs had certainly no Astronomy of their own, and probably none at all of others; and although he may have resolved on assuming the day of his exile for the first of his new æra, the task of fixing it permanently must have develved on his successors.

But the Alexandrian School and Library, were destroyed on the 2d Makorum of the 21st year of the Hejira, a time too near the beginning of the revolution to suppose that it may have been previously consulted on the construction of a new Kalendar. It is therefore more probable, that when in more settled times, Mahommed's successors resolved on that measure, they may have had recourse to their Indian neighbours, who since the destruction of the Alexandrian School were the only nation in the East who cultivated the sciences.



#### NOTE II.

On Dr. Hutton's Rule for finding the year of the Hejira.

It is difficult to understand on what principles Dr. Hutton has established the Rule which he gives in his Mathematical Dictionary for finding the Christian year concurring with any proposed year of the Hejira: it runs as follows:

"Reduce the given years of the Hejira into days by multiplying by 354, divide the product by 365½ and to the quotient add 622 years of the Hejira commenced."

[ Mathem. Dictio. Vol. I, page 593.

I fear that this rule is more remarkable for its brevity than for its accuracy (for the above passage contains the whole of the Rule). If it were sufficient to multiply the proposed years of the Hejira by 354 for obtaining the sum of days elapsed since its Epoch, what becomes, it may be asked, of the eleven intercalated days in the Cycle of 30 years, which make the years on which they fall be of 355 days, and in the course of 90 years retard the beginning of the Civil year by 33 days?—Let us try the merits of this rule by its results.

Let it be proposed to find the Christian year concurring with A. Hejira 1215.

We have  $1215 \times 354 = 430110$ ; and  $\frac{430110}{365\frac{1}{4}} = 1177$ ,  $+\frac{210,75}{365,25}$ , and lastly 1177 + 622 = 1799. So that following the letter of the precept A. H. 1215 would concur with A. D. 1799, which however, throughout Christendom and Islaamism is taken to be 1800; the 210 days which remain after division by  $365\frac{1}{4}$  are insufficient to account for such a difference, although they would bring the epoch of coincidence about 7 months later ( $206^4$   $17^h$  3' 31' being equal to that number of Lunar months), but these odd days end at no definite period; and no notice is taken of them in the precept: We are therefore compelled to conclude, that the very learned and justly celebrated author has only glanced at a subject which it did not enter into his views to investigate minutely, as may be inferred from the shortness of an article which, though intimately connected with Astronomy, was disposed of in twelve lines of his Dictionary.



#### POSTSCRIPT.

Some time after the Kala Sankalita was committed to the press, Mr. Bentley's posthumous work, entitled "An Historical View of the Hindu Astronomy from the earliest dawn of that "science, down to the present times" came to my hands, having just appeared for the first time in Madras, though published in Calcutta two years before.

On a cursory perusal of that production, (which remained only a few days in my possession, and at a time when I was engaged in editing the present work), I congratulated myself on having pursued an object totally different from that which Mr. Bentley had in view: For it was then too late to have benefited by his instruction; and in case of collision, with such unequal means and powers, I would have had cause to apprehend the judgment of the public on the issue.

Fortunately for me, Bentley soared to the highest regions of investigation, whilst I was collecting tools for labour, and toiling in the lower walks of research. He strove to drive error from the seat of truth, whilst I was employed in shewing how she ruled the population of the East, during many centuries of usurpation; in fine, his object was philosophic, and mine merely one of practical expediency. Our works may therefore (with an inverse degree of applause and censure) subsist together, and prove useful in their respective departments.

It will be observed that the abolition of Sydereal Astronomy pronounced by the work alluded to, to have taken place from the VIth century upwards, renders a great part of my speculations unavailing; to which I shall reply that, although agreeing in substance to a doctrine which the scholiast has so ably supported, yet I do not go with him the whole length of believing that the use of Ancient or Tropical Astronomy, was so suddenly relinquished, and the Sydereal so readily adopted, as might be inferred from the precise Epoch which he assigns to that event (March A. D. 533, page 73). It required nearly two centuries to drive the Aristotelean philosophy out of the Universities of Europe, and arguing from analogy, it is not to be supposed that a people, of all others the most attached to its institutions, would have simultaneously adopted new theories, when the old ones were still found to answer, (and were in reality better than the new), for no other purpose than to appear the most ancient nation in the universe (70);" for, although I do not pretend to say that Mr. Bentley meant to convey absolutely such a notion, yet his text bears that construction.

Before the Epoch referred to, the Sydereal Astronomy (certainly the most commodious of the two) must surely have thrown out some roots in the minds of the learned men of those times, and have lurked, perhaps during several centuries in the public opinion. Some sect of philosophers must have taught it; and some separate tribe or nation must have counted time by the same, before it became the general doctrine of India. And from the same considerations it may be believed

that Ancient Astronomy has left shoots which it must have taken time to extirpate. Nor can I believe that the Braminical power, (which rests entirely on opinion, great as it now is, and has been) can have proved so efficient as to have occasioned the sudden and total overthrow of the latter, in the same manner as Timur Long, and Nadir Shaw subsequently annihilated their public institutions. It is therefore highly probable, that Sydereal Astronomy began to be in repute, some hundreds of years before it openly superseded the Tropical one; and as to the motive of its abolition, I cannot be persuaded that the specific purpose of any set of men, when effecting a change can have been to do away their Ancient History (page 70).

Some old documents (and particularly inscriptions) may therefore still be found bearing dates in Sydereal account, more ancient than the Epoch assigned to its legal admission, and to these my Tables will apply. I beg it, however, to be understood, that I intend no review of Mr. Bentley's valuable production, for which I have neither leisure, means, nor abilities; most of his conclusions appear to me decisive, and, more than all the rest, those which attack the unfathomable antiquities of the Hindus. But I did not wait for the appearance of the "Historical View" to decide against them; for although unacquainted with Bentley's discoveries, I have long since been persuaded, and have declared it to be my opinion, that their periods and yugs were nothing else but mathematical contrivances, resting at one end on observations taken at the time when they were invented; and at the other, on some Epoch so very remote, that the greatest possible error in the position of the Planets at the time referred to (which could never exceed 6 signs in Longitude) must become almost insensible in their annual revolutions, and unimportant until after a great number of years intervene, either before or after the time of invention.

There is something so obvious in this view of the subject, that it cannot be wondered at, if Bentley funcied (though erroneously) that the attacks made on his doctrines were designed for him, personally. Another motive, perhaps equally reprehensible, was I fear, the hidden cause of their having been so frequent and repeated. In France I can affirm, on the verbal and written assurance of the late M. Delambre, that Bailly's doctrines never obtained any proselytes among men of real science; and when on a particular occasion the celebrated La Place asked me (\*) whether we Indian Gentlemen, and Members of the Asiatic Society, believed that any of the Indian periods were established on actual observations, on my assuring him of the contrary he expressed much satisfaction, and replied that he was sure such a notion could never have been long entertained by any Savant.

But I fear the author of the "Historical View" more justly ascribed the perseverance of some of his critics, to a bent towards infidelity, which in some instances was hardly denied; such was the prevalent philosophy at the close of the XVIIIth century. But as scepticism has now

<sup>(\*)</sup> At a meeting of the Board of Longitude in April 1816.

succeeded to incredulity, and as the ruling maxim of the beginning of the XIXth, is that any thing may be true, I have no doubt that the doctrines contained in that most profound work that has hitherto appeared on Hindu Astronomy, will meet with little or no opposition from any quarter; at least from such as the author need have cared for if he had lived to enjoy the success which I anticipate.

Whatever be the final opinion of the scientific world on the antiquity of Sydereal Astronomy, and the manner I have applied it to the construction of the Hindu Kalendars (which was the only province I was desired to investigate), I commit the present work to the judgment of the public with no sanguine expectation of success; but with a sincere desire that it may, (in its measure) prove useful to Chronology. Should I be disappointed in that expectation, I shall be consoled by the recollection of the amusement it has procured me during several years; and the opinion it has enabled me to form of the skill and ingenuity of the Natives of India, which, though duly appreciated by many of their rulers, is not sufficiently known to the great mass of Europeans who live among them.

END OF THE FOURTH MEMOIR.

# APPENDICES.

|  | • |  |
|--|---|--|
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  | - |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |
|  |   |  |

## APPENDIX I.

45 C 45

On the manner of computing the Ahargana for the beginning of the Solar years, and endof the Luni-solar years, counted from the commencement of the Cali yug, by means of the Tables, from which the Strostidi digona and Soota dina for either may easily bededuced.

ALL the Rules given in Hindu books for the resolution of the Ahargana, are very operose, and consequently liable to mistakes in the computation. It will be found, however, that in the Indian process, that Element is unnecessarily wrapped up in mystery; and that both the Solar and Luni-solar Aharganas may be obtained with perfect accuracy, by help of Tables which are neither difficult to use, nor to understand.

I shall first consider the Solar Table XLVIII, which is divided into two parts, the first giving the Ahargana according to the Surriah, and the second to the Aria Siddhantas.

Number of diurnal revolutions of the Stars in one year.

Table XLVIII.

According to the former Sastra, the duration of the diurnal revolutions of the Stars in one year is  $\frac{15\frac{8}{3}\frac{2}{3}\frac{1}{3}\frac{7}{8}\frac{2}{2}\frac{8}{6}}{60000}$ .  $366^d$  15° 31' 31° 24' and 1582237828 — 4320000, is the number of Bhumi savan (natural) days in a Maha yug: hence the Sclar Sydereal year, according to the Surriah Siddhanta is  $\frac{15\frac{7}{3}\frac{7}{4}\frac{4}{3}\frac{1}{2}\frac{7}{6}\frac{8}{6}\frac{8}{6}}{6}$ .  $365^d$  15° 31' 31° 24', and this quantity is the constant ratio of the first part of the Table.

Solar Sydereal year Surriah Siddhanta.

In the same manner the diurnal revolutions of the Stars in one year according to the Aria Siddhanta is  $\frac{15^{\circ} \cdot 20^{\circ} \cdot 375^{\circ} \cdot 50^{\circ}}{4320000} = 366^{\circ} \cdot 15^{\circ} \cdot 31^{\circ} \cdot 15^{\circ}$ ; and  $1532237500 = 4320000 = 1577917500^{\circ}$ , is the number of Bhumi savan days in a Maha yug; consequently the Solar Sydereal year is  $\frac{15^{\circ} \cdot 75^{\circ} \cdot 175^{\circ} \cdot 00^{\circ}}{43200000} = 365^{\circ} \cdot 15^{\circ} \cdot 31^{\circ} \cdot 15^{\circ}$ , which is the constant ratio of the second part.

Do, Aria Siddhan.

Lastly, we have shewn at page 12, 1st Memoir, that because the year which opened the Cali yug began 4° 51° 8' 45° from the commencement of an entire week, the Hindus, with a view to reckon from a complete period, added a *Cshepa* of 2' 8° 51′ 15° (complement to 7 days) to the Ahargana, which was the same thing as retrenching it from the Epoch itself.

It is therefore always to be remembered, that with respect to the true Epoch of the Call yug, there will be found that difference in the Tabular results.

For let the Christian date of the Yugadia, or first day of the Cali yug, be sought; proceeding as shewn at Example 5, page 26, with Table VII, and at the Example in page 30, with Table VIII, we shall find

Cohera or Equation to a complete week.

Date of the Cali yugadia 18th February A. A. C. 3101. By the Tables 16th February. And as the Dominical Letter for that year will be found to be B, the Yugadia under consideration falls on the 18th February of the year before Christ 3101 current, whereas the Hindu Tabular date, gives only the 18th.

As the Hindu Tables for finding the time of the Sun returning to the beginning of the Solar Zodiac, are affected by this Equation, it must be accounted for when calculating the Solar Ahargana; observing that, if computing from the Epoch the Cshepu becomes a Sodhyam or constant Equation to be subtracted from the aggregate sum of days, guddias, &c. reckoned from the assumed Epoch as given in the Table.

The preceding considerations will suffice for explaining the construction of the first and second parts of Table XLVIII; we shall now give some Examples of their use.

#### EXAMPLE I.

Example I, 1st part of Table XLVIII.

1º Wanted the Solar Ahargana for the beginning of the Solar year 4924 of the Cali yug, or 4923 complete, answering to A. D. 1822, according to the Surriah Siddhanta.

And for the Soota dina 7)1798166d(25688

with a remainder of 6 which counted from Friday, shews that the Soota dina or initial feria falls on Thursday.

2º Wanted the Ahargana for the 1st of the Solar month Vrischica masha m; the modern Márgasíras; and of the Tamul denomination, Cartiga.

Ahargana, 1st Margasiras; which divide by 7)1798383 (30 51 25 51

remainder 6 and counted as usual from

Friday, gives the Soota dina on Thursday.

There being not the least difference from what precedes in the manner of using the second part of Table XLVIII, and all cases, either according to the Surriah or Aria Siddhantas, being to be resolved precisely in the same manner, I shall dispense with giving any more Examples for the Solar Ahargana.

To find the Luni-solar Ahargana by means of Table XLIX.

The construction of both parts of this Table, is as simple as that of the preceding one. Its whole theory rests on what follows.

For the Luni-solar Ahargana, Table XLIX.

According to the Surriah Siddhanta, there are 57753336 periodical revolutions of the Moon in a Maha yug or 1577917338 natural days. Hence the Moon's periodical month is  $\frac{15}{3}\frac{773}{773}\frac{1772}{333}\frac{2}{33}\frac{2}{33}$ , or 27d 20g 20v 21p 30s,77, &c. (27d 8h 8' 8" 39",6 European time.) From the number of periodical revolutions in a Maha yug, subtract the number of Solar days in that period, or 57753336 — 4320000, you have the number of Synodical revolutions in the same time, = 53433336; and  $\frac{15}{5}\frac{77}{34}\frac{117}{333}\frac{128}{36}$  or 20d 31g 50v 6p 50s,73 (20d 12h 44' 2" 47",6 European time) is the duration of a mean Lunation, according to the Surriah Siddhanta: a mean Lunar year of 12 months is therefore equal to 351d 22g 1v 23p 57s,14 (354d 8h 48' 33" 48" European time) which is the constant ratio of the first part of Table XLIX.

First part.

That of the second part is deduced from the same principles, the only difference being that the Aria Siddhanta counts only 15779175200 natural days in a Maha yug. According to that authority the Moon's periodical month is therefore 27<sup>4</sup> 19<sup>5</sup> 17<sup>7</sup> 58<sup>9</sup> 29<sup>9</sup> &c.; the Synodical 29<sup>4</sup> 31<sup>5</sup> 50<sup>7</sup> 5<sup>7</sup> 40<sup>7</sup>,21, and the Lunar year of 12 months 354<sup>1</sup> 22<sup>5</sup> 1<sup>7</sup> 8<sup>9</sup> 2<sup>5</sup>,6 which is the constant ratio of the said second part.

Second part.

Considering how very intricate the process is for finding the Adigah months and Cshaya Tidhis by the Sastra rule (\*), I originally concluded that there could be no simpler means for finding the Luni-solar Ahargana, and when from stress of labour I endeavoured to free myself by means of Tables, from those perpetual rules of three which it imposes, a typographical error in Mr. Davis' paper on the Astronomical computations of the Hindus (†), making the Lunar Synodical month 29<sup>d</sup> 31<sup>x</sup> 50<sup>x</sup>,6 instead of 29<sup>d</sup> 31<sup>z</sup> 50<sup>x</sup> 6<sup>p</sup> &c. for a long time defeated my endeavours. But when once I had discovered the erratum, there was no further difficulty in constructing my Table, which I subjected to the following test.

We have seen in the article of mean interculations, Part III, Article 1 of the second Memoir, that the period of recurrence of an Asiguh month was 2y 8m 16d 3g 55v &c. and I resolved the same by means of the first part of Table XLIX, as follows:

Epochs of interculations by the Lables,

<sup>(\*)</sup> Vide Key to the Siddhanta Chandra Mana, Part II, Article L.

<sup>(†)</sup> Asiatic Researches, vol. II, page 23?, English Elition, which teems with errata of the most fatal kind to the true exposition, and acquisition of the first nations of Hindu Astronomy, from that otherwise, elegant production.

| The mean Solar Sydereal year being      |           | <b>7.</b><br>365 | <b>6.</b><br>15 | <b>v.</b><br>31 | <b>P.</b><br>31 | 8,<br>21 |
|-----------------------------------------|-----------|------------------|-----------------|-----------------|-----------------|----------|
| And the Lunar year of 12 months         | •         | 3.54             | <b>22</b>       | 1               | 23              | 57,14    |
| The annual difference is                | -         | 10               | 53              | 30              | 7               | 26,36    |
| So that for one month of 30 days the Eq | uation is |                  | 54              | 27              | 30              | 37,23    |
| And for one day of 60 guddias           | -         |                  | 1               | 43              | 55              | 1,273    |

If with these quantities we expound the period of intercalation referred to, we shall find

| For 2 years                         | - |          |          | 0                |   | 53 <b>,72</b>                  |
|-------------------------------------|---|----------|----------|------------------|---|--------------------------------|
| ,, 8 months<br>,, 16 days           |   | 1        | 15<br>29 |                  |   | 57,8 <b>1</b><br>2),0 <b>7</b> |
| Which subtract from 1 mean Lunation | • | 29<br>29 | 31<br>31 | 4 <b>2</b><br>50 |   | 11,63<br>59.78                 |
| Difference                          | • |          |          | 7                | 9 | 48,15                          |

and for the time due to this difference say, as 1° 48′,91 (the Equation for one day), to 3600 (the number of viguddias in a day of 60 guddias'; so 7′,15 &c. (the difference to a mean Synodical month), to 3° 55′,8 &c. which, with the above quantities, gives the time due to the intercalation of one mean Lunar month, 2y 8\omega 16d 3g 55v,8 &c. very nearly the same as was found by the Hindu rule referred to.

Having premised thus much, I shall give the following Precept and Example.

#### PRECEPT.

Find the Solar Abargann of the proposed Luni solar year for an Index,

The same by the Hindu rule.

- 10 Find the Solar Ahargana for the proposed year of the Cali yug, which will serve as an Index for finding the Luni-solar one.
- 2º Take out of the two first columns of Table XLIX, part 1, the quantities answering to as many Lunar years of 12 months as there are Solar ones proposed, and add them together: the rest of the operation will serve to find the intercalations.
- 30 Subtract the sum of days, &c. so obtained (reglecting the fraction) from the sum of days of the Solar Ahargana, and take out of Table XLIX the quantity nearest to the remainder, which write both under the Lunar sum and the remainder of the Solar Ahargana, of which take again the difference; follow the same process as before until the last remainder under the Solar Ahargana be less than a mean Lunation, which in that case neglect.
- Manner of using the Table.
- 4º Cast up all the Lunar periods so obtained, and the sum will be the Luni-solar Ahargana sought.
- N. B.—This process has the advantage that in no case whatever the Luni-solar, can exceed the Solar Ahargana, which is not the case in the Sastra rule, and that it shows at once the number of intercalary months which have been introduced in any proposed interval. The Precept applicationally to part 1 and 2 of Table XLIX,

#### EXAMPLE II.

|               |                            |                        | Υ,                      | D.             | G.  | ₩.    | P.         | s.     |
|---------------|----------------------------|------------------------|-------------------------|----------------|-----|-------|------------|--------|
|               | Table X4                   | IX, part 1, column 2 - | 4(0) -                  | 1417468        | 13  | 16    | 49         | 20     |
| Som of days   |                            |                        | 900 -                   | <b>3</b> 18930 | 20  | 59    | 17         | 6      |
| Abargana fou  | ind by Tab                 | ie –                   | £0 <b>-</b>             | 7087           | 20  | 27    | 59         | 2,3    |
| XLVIII -      | 1793166<br>174454 <b>9</b> |                        | 3 -                     | 1063           | 6   | 4     | 11         | 51, 12 |
| (1)           | 1/11/19                    |                        | (1                      | 1711519        | 0   | 43    | 17         | 50,22  |
|               | 53617                      | ۲                      | 100 (2                  | 35133          | 42  | 19    | 55         | 1.1    |
| (2) -         | 35436                      | ¥ 1= 1 = 1 4           | 50 (3                   | 17713          | 21  | 9     | 57         | 27     |
| ` '           |                            | Intercalations.        | 1 (4)                   | 354            | 22  | 1     | 23         | 57,11  |
|               | 18181                      | i 3 Lunar              | months (5               |                | 25  | SO    | 20         | 59,31  |
| (3) -         | 17713                      |                        |                         |                |     |       |            |        |
| (-)           |                            | Ahargan                | a sought                | 1798147        | 1   | 49    | 5 <b>5</b> | 7,70   |
|               | 463                        | By the 1               | ellinga rul             | 1798147        | 1   | ž٥    | 32         | 0      |
| (1)           | 351                        | •                      | •                       |                |     |       |            |        |
| • •           | <del></del>                | D                      | ifference               | -              | -   |       | <b>5</b> 6 | 52,3   |
|               | 109                        |                        |                         |                |     |       |            | . , .  |
| <b>(5)</b> -  | 83                         | But as the day currer  | nt is wante             | l, and as 13   | 49v | 55p l | ave a      | iready |
| <b>37</b> 1 . |                            | expired of it,         | T 1700                  | 1 (97          |     |       |            |        |
| Neglect rema  | ainder 21                  |                        | To 1793                 | 11/            |     |       |            |        |
|               |                            |                        | $\mathbf{A}d\mathbf{d}$ | 1              |     |       |            |        |

Ahargana to be used 7)1798118(256378

Remainder 2 i. e. Saturday the Soota dina:

and as this Element is only used to the nearest day, the difference of 36,5 paras, from whateverit proceeds, is of no sort of importance.

As 151 Lunar years and 3 months have been intercalated for bringing the Luni-solar to the nearest possible time of the Solar Ahargana, it follows that in 4923 Solar Sydereal years (account of the Surriah Siddhanta) there have been 1815 Luni-solar months intercalated.

For the Strostidi

```
Lastly, if to the constant number - 714102296527 days
We add Ahargana - 1798148
We have the Strostidi digona for A. C. 4923 - 714404094775
```

as accurately as if it had been computed by the process explained in the 1st Article of the 2d Part of the Kry to the Siddhanta Chandra Mana.

The rule by the second part of Table XLIX being precisely the same as the preceding one, mutatis mutandis, no Example is necessary; I shall only state that the Ahargana n. c. v. r. s. according to the quantities used in the Aria Siddhanta for the same year is 1798146[39 21 28 53,0]

2d part of Table XLIX.

```
And consequently for the current day - + 1

And for the Soo's dins - - 7)1798117(256878

remainder 1 which counted from Thursday, gives Friday for the Soota dina.
```

Here it may be observed that according to the Surriah Siddhanta, p. 6. v. p. s. the Ahargana was - 1793117 1 49 55 7.7 And by the Aria Siddhanta - 1798125 39 24 23 53,0 Difference 22 25 26 14.7

Difference of Lunisolar Aharganas by the Surriah and Aria Sidduants. Of no consequence.

So that although by the Soota dina, there seems to be one day of difference for the conjunction, yet there is in fact only 222 257 26P 145,7 disagreement between the two accounts, which difference is of no sort of importance, because in the computation of the Tidhis, the Sun and Moon's real positions in Longitude at mean midnight at Lauca, and not the time wrought by the rule, are what determine the beginning of the Lunar month, which will find its true place whether we use Friday or Saturday as the day to work for.

Generally the Southern Astronomers, though working in Solar time, prefer making use of the Lunar Ahargana of the Suniah Siddhauta.

Case where the Lunisolar is greater than the Solar Ahargana.

An interculary month to be retreached when using the Sastra rule.

Not to be cared for when using the Tables. It sometimes, though rarely, happens that on certain years (as will be the case at the end of the 4951st year of the Cali yug, answering to A. D. 1850) on computing the two Abarganacrby the Sastra rules, the Luni-solar will be found greater than the Solar one; which would seem to indicate that the Chandra Mana begins, after the Solar year: but in such an occurrence the rule directs that an intercalary month be retrencted, from both Aharganas, and thus the antecedent conjunction determines the beginning of the new Astronomical year. This of course disturbs temporarily the order of the intercalations; and is the cause why the original series in the Cycle of 19 years undergoes a change in its disposition (\*): but the only consequence in the Kalendar is, that as the year on which the case occurs would have been embolismic, it becomes a common one, and that the following one from common that it would have been, becomes an intercalary one. On working the two Aharganas by the Tables XLVIII and XLIX, there can be no fear of a mistake respecting the true commencement of the Chandra Mana arising from the above cause; because by the Precept, the Lunar is unavoidably kept below the Solar Ahargana.

(\*) Vide page 60,

END OF APPENDIX I.

# APPENDIX II.



Describing a particular method for expounding dates found in old Inscriptions, the only vestiges of which consist of the recorded years expired since the beginning of the Culi yug, from the birth of Salivahana or of the Cycle of 60 years, and of the Sun's apparent place in the Hindu Sydereal Zodiac at the time of the commemorated event, and also, for referring the Epochs of ancient phænomena recorded in European time, to their corresponding Hindu Solar dates.

Object of Appendix

The questions under consideration are to be resolved by means of certain formulæ which enable the computer to refer the Sun's mean place in the Indian Sydereal Ecliptic, as deduced from the time assigned to his entering any of its Signs in the Solar Kalendar, to his mean place in the European Tropical Ecliptic, at the same instant of time, by one single operation; thus affording means for correcting the Hindu Solar Tubles, and also those of the Planets, as far as the computation of their position depends on the Sun's place and the beginning of the Sydereal Zodiac, the duration of the Solar year being 365<sup>a</sup> 15<sup>c</sup> 31<sup>c</sup> 15<sup>c</sup>.

To refer the Sun's mean place in the Indian Sydereal Ecliptic, to his mean place at the same instant in the Luropean Tropical Leliptic, by one single operation.

I have stated in the Preface of this work (page iv), that my intention was to expound the operations of the system now generally in use in these parts of India, as if it had been followed during all past ages, and were to continue to be so to the end of time; and in the present tract my purpose remains unaltered, although I profess to be one among those who have no faith in that proposition. Any person who has looked into books of Hindu Astronomy knows, that in remote times the Solar year was made to begin successively with the months Aswina (now the 6th of the year), Cartica, Margasiras (\*), Paushia, Magha, Phalguna, Chaitra, and lastly Vaisácha (†); the line of the Ricshas or Rishis (‡) intersecting at the corresponding times the first points of

The present Hindu system of Astronomy supposed permanent.

Not so in reality,

<sup>(\*)</sup> The name of which was changed into that of Agrahayan on that occasion.

<sup>(+)</sup> In the present paper I shall use the Bengal denomination of the Solar months in preference to that of the Tamul, being more generally known; though, from the Bengal names being the same as those of the Lunar months, the latter be less convenient, because less distinct.

<sup>(†)</sup> The line of the Ries'ns, as called in Tellingana, and Rishis in Bengal, is a great circle passing through the Pole of the Feliptic, cutting a certain Star in the Constellation of the Creat Bear, called Maha Riesha, supposed by some to be β, by others to be 7 or δ Ursæ Majoris, and meeting the Hindu Yoga Star Vaidheiti, believed to be the same as ζ Piscium, although no great circle passing through the Pole of the Ecliptic could be made to intersect with any precision, any three of these points.

the Lunar mansions Chitra, Vaisacha, Jyśstha, Purva Ashádhà, S. ávana, Satabhisha, Uttara Bhádrapuda, and lastly Aswini, which according to present theories, marks the beginning of the fixed Lunar and Solar Zodiacs.

Epochs of the various beginnings of the Hindu Solar year the subject of much discussion.

Not considered in the puper.

The Solar Sydereal system supposed to have been introduced in A. D. 538.

Uncertainty of the n cit ods Intherto used for expounding ancient Hindu dates,

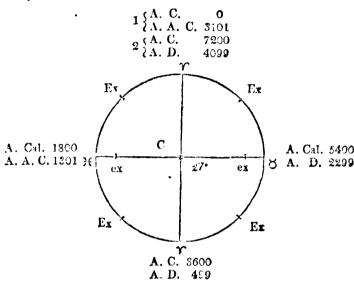
The Ayanansa, the principal Liement used in this research.

At what precise Epochs these changes have been effected is a question which, for the last five and twenty years, has divided those of our European cotemporaries who have cultivated Hindu Astronomy; and as the succession of these changes must have depended on the precessional variation, the motion of the Equinoctial points has given rise to discussions which would have been rendered still more animated, if the Native Sastras had been called upon to take a part in them. With these changes, and their Epochs, I shall have nothing to do. The labour of a man's whole life would probably not suffice to pass a competent decision on such divergent of inions, and no time would remain to apply a final resolution to any useful purpose. It suffices to mine to know, that the most averse to the antiquity of the Surriah Siddhanta admit, that its dectrines have been followed by Indian Chronologists from so early a period as A. D. 538, to the present times; whilst other no less respectable authorities, without going the length of supposing that it was revealed in the 17,27900th year of the Treta yug, have thrown that Epoch so far back as A. A. C. 2041, that is to say, 311 years after the universal deluge. But confining ourselves to the most moderate of these computations, it will no doubt be admitted that a system of Chronology which has lasted 1287 years (A. D. 1825), and according to which almost every Kalendar that has been used in India (\*, whether Solar, Luni-solar, or Planetary, was constructed, was well worthy of investigation; for its application cannot fail to find materials for consideration, little doubt existing in my mind but that the dates of many considerable events recorded in Indian history lie hid from Europeans, or are much mistaken by them, for want of a competent instrument for unravelling the various Kalendars which have passed through their hands during the last century.

As the problem under consideration depends chiefly on the relative position of the Hindu Sydercal and Tropical Ecliptic, the Ayanansa or Arc of distance between the Vernal Equinoctial point, and the 1st in the Solar Sign Mesha  $\gamma$ , is an Element which, (as it is understood by the

<sup>(\*)</sup> In the country called Malayala, extending along the greatest part of the Coast of Malabar between Mangalore and Cape Comorin, the Natives reckon time from the birth of Parasurama, which they divide into Cycles of 1000 years. The years of that Epoch begin on the Sun's entrance into the Sign Canya M, which answers to the month Aswini, the sixth in the present order of the Solar months. Dr. Buchanan has calculated that in the month of September A. D. 1800, two complete Cycles had expired since the Epoch, and that the year beginning was the 977th of the third. This computation throws, therefore, the birth of Parasurama in A. A. C. 1176. I regret that my ignorance of the existence of that style when I was on the Coast of Malabar, prevented me from enquiring into the particulars of the Malayala Kalendars. I believe however, that their circulation is very confined, for in the Northera Provinces of that Coast the Natives chiefly reckon from the birth of Salivahana.

modern Hindu Astronomers) must be clearly defined; therefore, although I have already spoken of it at page 84 and other parts of this collection, I shall give here a detailed account of its Phases, without pretending, however, to decide on the grand question whether the original invention of Hindu Astronomy conceived it to librate in an Arc of 27° of the Ecliptic on each side of  $\gamma$ , to revolve in an Epicycle about the same point as a center, or to move round the Platonic Cycle in a period of 24000 years.



If the Ayanansa be considered to revolve in an Epicycle, let each of the Quadrants  $\Upsilon \times$ ,  $\Upsilon \otimes$ , be supposed to be equal to an Arc of 27° of the Deferent: but if it be supposed to librate from C to  $\otimes$ , and from C to  $\times$ , let the radius C  $\otimes$ , or C  $\times$  be divided into 27 parts, each equal to 1° of the Ecliptic, and to either supposition what follows will apply.

Phases of the Ayanansa, whether supposed to move in an Epicycle, or to librate on each side of  $\gamma$  in the Hindu Sydereal Ecliptic.

Imagine a point Ex in the circumference of the Epicycle, or another ex in its diameter, revolving in one supposition from  $\gamma$  to  $\aleph$ , or in the latter from C to  $\aleph$ , at the annual rate of 54" of a degree, the Indian *Cranti-Putagati*, or precessional variation.

First Padah or Quadraut.

Then in the Epicircular hypothesis from the year 0 to 1800 of the Cali yug complete, Ex (and ex in the libratory) will have moved through an Arc equal to 27° of the Deferent or Ecliptic, contrary to the order of the Signs: and as in the first and second Quadrants the Ayanansa is negative, the Tropical Longitude of the Vernal Equinoctial point at the beginning of the year, or (as Europeans would consider it) that of the beginning of the Sydereal Zodiac would be 12° — 27° — 11° 3°, shewing that the Equinoxes were then in 3° of Min  $\aleph$  and of Canya  $\aleph$ .

From this limit, which it is supposed never to exceed, or from the year 1800 to 3600 of the drant.

Cali yug complete, the Ayanansa will have decreased until Ex coincided with  $\gamma$  in the lower part of the Epicycle (or ex with C) when it became again equal to zero.

2d Padah or Quadrant, The Ayanansa positive or negative.

The Longitude of  $\gamma$  is the Supplement of the Ayanansa to 12s, when it is negative.

The Longitude of the same is equal to the Ayanansa when the latter is positive.

Third Padah or Quadrant of the Ayanassa.

Fourth Padah or Quadrant.

In the 2d and 3d Quadrants of the Ayanansa the Hindu and European precessional variation may be compared by one single operation.

In the 1st and fourth, it requires ino.

It is to be observed that during the two first Padahs, or Quadrants, although Ex in the first, moved contrary to, and in the second according to the order of the Signs, yet as in both cases it lies West of  $\gamma$ , it is negative; therefore the Longitude of the first point of the Sydereal Ecliptic, is the Supplement of the Ayanansa to 12 Signs. And for the same reason, because in the third and fourth, Ex lies East of the same, moving in the direction of, in the 3d, and contrary to, the Signs in the 4th, the Ayanansa becomes positive (i. e. from A. Cm. 3600 until 7200), during which interval the Longitude and the Ayanansa are one and the same thing.

It need hardly be added that when Ex, after having passed  $\gamma$  (or ex, C) coincides with  $\aleph$ , which will occur when 5400 years of the Cali yug have expired, then its Ayanansa and Longitude will be  $+27^{\circ}$ , shewing that the Equinoctial points will then be in  $27^{\circ}$  of Vrisha  $\aleph$ , and Vrischica  $\Re$ ; and lastly, that when 7200 years of the Cali yug have expired, Ex will have regained  $\gamma$  in the superior part of the Epicyle (or ex, C), and therefore the Ayanansa, as well as the Tropical Longitude of the first point in the Sydereal Zodiac, will be equal to zero.

As the Supplement of the Ayanansa to 12 Signs, in the 2d, and the Ayanansa itself, in the 3d Quadrants of the Epicycle, increase in the same manner as the European precessional variation, the Arc of distance between the first point of the Sydereal Ecliptic and the Equinox Ex (i. e. between A. A. C. 1301 and 2299) in the said Padahs, may easily be compared to the Tropical Longitude of the same point, computed by means of the European Tables.

But as in the 1st and 4th Quadrants (i. e. from A. A. C. 3101 to 1301 complete in the first, and from A. D. 2299 and 4099 in the fourth) the Hindu theory supposes that Ex, or ex returns towards  $\gamma$  or C, with contrary Signs; whereas by the European doctrines, these continue to recede therefrom according to the laws of the precessional variation, until Ex or C have reached their greatest elongation in the great scope which they have to describe, the Equation of the Ayanansa to the European Tropical Longitude at either season is of course equal to nearly twice the Cranti-Patagati (the motion of the Equinoctial points) due to the number of years elapsed between A. A. C. 3101 and 1301 in the first Quadrant, or between A. D. 2299, and 4099 in the fourth; as shall be shewn hereafter.

From what has been said it follows, that if any document could appear, which should bear as its only distinguishable date, the Sun's place in the Indian Sydereal Ecliptic, according to the fictitious system of the Ayanansa, in any year comprised in the said first and fourth Quadrants, another Equation would be required to refer the mean Longitude of Ex (or ex) in the Sydereal Zodiac to its true Longitude in the European Tropical Ecliptic.

As this work has principally practice for its object, instead of giving an analytical demonstration of the problems under consideration, I shall disclose the theory on which they rest by a number of Examples, which will present them under every aspect that such questions may assume: and it will be found in the present case, as in every other treated of in this collection, that the

The problem under consideration demonstrated by the result of several Examples. most difficult task imposed on the reader as well as the author, does not arise from the application of deep scientific knowledge, but from the difficulty of exposing briefly, and understanding clearly, methods which have little analogy with those used by European mathematicians.

To find the Tropical Longitude of any point of the Hindu Sydereal Ecliptic, as computed by the Native Astronomers, presents no sort of difficulty: the problem consists merely in the computation of the Ayanansa explained at page 86, and rendered still more easy by Table XXXV, and in adding the same if positive, or its Supplement to 12 Signs if negative, to the proposed Sydereal Longitude in the Ecliptic, if it be occupied by the Sun, or in the Orbit of the Planets if these be considered, referring it however, to their obliquity with the Ecliptic in the latter case. The sum of the Ayanansa and Madhyama Graha (mean place in the Sydereal Zodiac) is what the Hindus call the Sayana or Tropical Longitude of the Aster when in the proposed point, which they no longer count by the names of the Solar signs Mesha, Vrisha, Midhuna, &c. but by I, II, III, &c. as European Astronomers are in the habit of doing.

The Hindu Tropical Longitude of any point of the Ecliptic deduced from its position in the Hindu Sydereal Ecliptic, by means of the Ayananus.

As also that of the Planets.

The Hindus count the Signs of their Tropical Ecliptic by their numerals.

But the present question involves one consideration more, namely, how to deduce at once the European Tropical mean Longitude of a point given in the Hindu Sydereal Ecliptic, without any other reference to the Indian Tropical Zodiac than the consideration of the Ayanansa at the beginning of the Hindu Solar year when the Sun is in the proposed point of his Orbit.

Reduction of a point in the Hindu Sydereal to the European Ecliptic, considered.

The operation which forms the subject of this paper depends entirely on an annual Equation of 1' 45",6 European time (4' 24",04 Hindu time = a) amounting in a century to 2h 56' 1",6 European time (7' 20' 4P Hindu time = S) to be applied ± to the time when, according to the Hindu computation, the Sun occupies the proposed point, as shall be shewn hereafter. But the Longitude deduced from the time so equated is subject to a small reduction, by drawing the same into  $\frac{54''}{54'' 1 - 15'''}$  as it answers to a precessional variation greater by 1" 15" than 54" per annum. (\*)

Elersents, Value of A, and S.

Reduction of the precessional variation supposed to be 54"1" 15"" to 54".

## General View of the Proposition.

It was found in the course of this research that the European Tropical Longitude of the Sun, when in a certain point of the Hindu Sydereal Ecliptic which corresponds in time to the 14th December of A. D. 2519, Julian Style (†) at 18° 53′ 14″ P. M. under the Meridian of Paris, will be precisely the same as that which would result if computed by the Ayanansa due to the beginning of the 5621st year of the Cali yug; plus the Sun's mean motion for 253° 7° 18′ 54′,6 (18° 17′ 17° Hindu time) at Lanca. But it was also found, as stated in the present page, that the

Epoch witen S and a == 0,

A. C. 5621, 7th Paushia.
A. D. 2519, 14th December, Julian Style; 25th December, Gregorian Style.

<sup>(\*)</sup> This part of the Equation is subtractive when the Longitude equated by means of S and a, which gives always that which would result of a precessional variation of 54" 1" 15", is greater than by 54", and vice versa; but the multiplication by 54" 1" 15" is dispensed with by help of Table XXXVI.

<sup>(+) 28</sup>th December, Gregorian Style.

divergence of the European Tropical, and Hindu Sydercal Solar Tables, from that instant of time increases precisely at the rate of 1'  $45\frac{1}{4}$ " per annum; it follows therefore, that if this Equation, which I call a, its multiples or fractions, be applied with contrary Signs in ascending and descending years, to the time when the Sun, by the Hindu account, is in the proposed point of the Sydereal Ecliptic, his Longitude answering to the time so equated, drawn into  $\frac{5^{10}}{54^{9}1^{2}10^{4}}$  will be the same as would result from its being computed with reference to the Ayanansa, the difference of the proposed Hindu and equated time shewing the error of the Indian Solar Tables.

How to compute the error of the Hindu Solar Tables on which the Kilendar is constructed.

Gereral fore.ula.

If therefore, the remoteness of an Epoch (A. D. 2519) which is thrown so far off from our times; and the inconveniency of a broken period of 253 days, &c. from the commencement of the Hindu Solar year, were not a strong objection against its being resorted to, the following general formula would be found to apply to all past and future times.

 $T = \beta + (SuC + ma) + dx$ 

where  $\beta$  represents the time when the Sun is in the proposed point of the Ecliptic. S = the secular Equation 73 20v 4p Hindu time; SnC  $\pm$  any multiple of the same;  $a \equiv$  the annual Equation 4v 24p,04 Hindu time; ma  $\pm$  any multiple of the same (\*);  $dx \equiv$  the correction adverted to in the note at the foot of the preceding page; and  $T \equiv$  the equated time sought, which will indicate the error of the Hindu Solar Tables.

It. notation,

The broken period of 19 years, 3484 13h 53' 14" referred to the Julian year and Meridian of Paris (preceding page), or of 2534 7h 18' 54",6 referred to the time of the commencement of the Hindu Solar year 5621, may easily be done away, by referring the above formula to the beginning of the century (A. D. 2500), which would then correspond to the 5602' year of the Calivus; for say

13th December (the 3.8th day of the year) answering to 7th Paushia.

365<sup>d</sup> (one common year):  $4^{\circ}$  24°,04:: 19° 253<sup>d</sup> 18° 17° 17° :: 1° 26° 40°, which last term calling  $\triangle$ , the new formula for all years ascending from A. C. 5602 (A. D. 2500) will be,

 $T = \beta + SnC + \Delta + ma \pm dx$ 

and it will be found sufficiently accurate for all practical purposes.

But these Epochs are too remote from our times, not to be extremely inconvenient in practice. In the following tract, I have therefore referred the general formula to two different Epochs, viz. to the year of Christ 1700 for ascending, and 1800 for descending Julian years, the intermediate Hindu Solar years which concur with those of the 18th Christian century, being subject to two special formulæ, reducible as the others to the general one.

Formula for all years ascending from A.C. 5802, A.D. 2530.

In all cases it is to be understood, that the Julian Kalendar alone is to be referred to in the resolution of problems depending on the Sun's position in the Hindu Sydereal Ecliptic, on account

Offer Fpechs preferred, the formula adapted to the same.

The Julian Kalendar alone is to be used in the resolution of questions.

<sup>(\*)</sup> In case of fractions of years a will be found equal to Op,7233, the equation for one day, and 146 12p,3418 for 100d. from which the fraction for any number of days may easily be deduced.

of the 25 Bissextile years of that style in a century (all Secular years being Leap ones) and the invariable regularity of its construction.

The application of the method under consideration supposes a knowledge of the use of the European Solar Tables, which implies no great degree of science, for all that is required of the computer is, that he should know how to find the Sun's mean Longitude for any year, day or instant that may be proposed. (\*)

# Notation, Formulæ, and Examples.

The foregoing introduction seeming sufficient to give a general notion of the nature of an instrument which I have used with success for the resolution of some very remote and obscure cases, I shall now proceed to show how it is to be handled, and conclude by showing its application.

It is to be regretted that the remoteness of the Epoch to which the general formula refers has necessitated the splitting of it, into several special formula, which give an appearance of complexity to the problem, which in reality it has not, and which has increased the notation beyond the usual measure; but if the reader has the patience of expounding a couple of cases, he will soon find that the process is by no means a delicate one, and that he need not be detained more than a quarter of an hour on any one case that can be proposed.

Instead of presenting the formulæ collectively, I have separated them into several propositions, which will render the references easier, and prevent confusion.

### Notation.

- Let \$\beta\$ represent any time according to the Hindu Solar Sydereal Kalendar, where the year consists of 365° 15° 31° 15°, the Hindu monthly date being previously expounded into its concurring European date according to the Julian Kalendar, (vide Key to the Madhyama Saura mana), but the fractions of days remaining expressed in guddias, viguddias and paras.
  - S= The secular Equation 7° 20° 4° Hindu time (2° 56′ 1°,6 European time) mentioned at page 249.
  - nC= Any number of centurics.
    - a= The annual Equation 4' 21',04 Hindu time (1' 45',6 European time) mentioned at the same page.
- a × D = The same Equation for any number of days not exceeding one year.
  - ma Any number of years not exceeding a century.

<sup>(\*)</sup> As all sorts of Tables are scarce in India, I have compressed D-lulande's four first Tables (Edition of 1764) into two, and added at the foot directions for using them; these will be found in Table LII, part 1st and 2d.

- A= A constant Equation applicable to all years ascending from the 4802d of the Cali yug

  (A. D. 1700) =7' 12" Hindu time (2' 52" European time).
- B= A constant Equation applicable to all years descending from the 4902d year of the Cali yug (A. D. 1800) =7° 12° 52° Hindu time (2° 53′ 8″,6 European time.
- E= A constant Equation applicable to all Hindu Solar years from the 4804th to the 4899th year of the Cali yug (A. D. 1702 to 1799) answering to the 97 last years of the Christian 18th century =1' 36',08 Hindu time (24',2 European time).
- T= An Equation applicable only to the 4803d year of the Cali yug (A. D. 1701) == 2' 47',66 Hindu time (1' 17",1 European time).
- △= A constant Equation, being one of the terms of the formula which applies the computations referred to the 5602d year of the Cali yug (A. D. 2500) =1° 26° 40° Hindu time (34° 40° European time) as stated at page 250.
- x= The general multiple 54" mentioned at page 249.
- dx A correction which dispenses from using the multiple x, being the difference of the Ayanansas given in Tables XXXV and XXXVI, to be applied +, as stated in the note at the foot of page 249.

H= 6 hours (constant).

- L= The difference of Longitude in time between Paris and Lanca (constant).
- T= The time sought.
  - N. B.—As H and L are constant quantities, and are applied in the same manner in all cases, they are not considered in the formulæ, although they are always used in expounding them.

### Proposition I.

- "If to the time of the beginning of the  $5602^a$  year of the Cali yug (A. D. 2500) you add the constant quantity 15 26v 40v (34' 40")  $\triangle$ ; and if for any other Solar Sydereal year ascending
- "therefrom, besides the said quantity A you add 4, 24p,04 (1'45',616 European time) a
- " for each year; and 7g 20v 4p (2" 56' 1",6) S for each century, the Sun's mean Longitude due
- "to the time so equated drawn into  $\frac{54''}{54'' \cdot 1^{2''} \cdot 15^{79}}$  will be equal to the Ayanansa or its Supplement
- " for the beginning of the said Solar year."
  - "And the general formula for all years not exceeding the 56024 of the Cali yug will be

$$T = \beta + (SnC + \Delta + ma) \pm dx$$
 (\*), (page 250)

(\*) The term dx is the difference of the Ayaranta given by Tables XXXV and XXXVI converted into time by means of Table LII, and dispenses from drawing the Sun's Longitude due to the equated time into \frac{54''}{54'' \ 1''' \ 15'''}.

It is additive when the Ayanansa or its Supplement to 12 Signs (when it is negative) is greater than that given by Table XXXVI, and subtractive when it is less.

Special formula for all years ascending from 5602 Cali. A. D. 2500, to any assignable time. where nC represents the number of centuries, and m the number of years between that which is proposed, and the Epoch 5602.

### PROPOSITION II.

- " If to the commencement of the 4802 year of the Cali ying (A. D. 1700) you and one day
- 46 and the constant quantity 7° 12° (1' 45',6 European time) A; and if besides the said quan-
- "tity, you ald for any other year ascending therefrom the value of a for every year, and of S
- " for every century as above noted, the Sun's mean Longitude due to the time so equated drawn
- 66 into  $\frac{53^{\theta}}{55^{\theta}1^{\theta} \cdot 15^{\theta}\theta}$  will be equal to the Ayanansa, or its Supplement to 12 Signs if it be negative,
- " for the beginning of the said Solar year.
- "The formula for all years ascending from A. C. 4802 (A. D. 1700) to any Epoch not 66 exceeding A. C. 1800 (A. A. Christ, 1801), will be

$$T = \beta + 1 day + (SaC + A + ma) \pm dz$$

- " the notation remaining as before.
  - "The formula for A. C. 4802 (A. D. 1700), is therefore merely

$$T = \beta + 1 \operatorname{dis} y + A = \operatorname{dix}$$
.

# Proposition III.

- "If to the commencement of the 4002 year of the Call yug [A. D. 1800) you add I day, Special for all years
- and from the sum you subtract 7: 12" 52" (2" 55" 8", 5 European time) B; and if besides the said 6. 4902, A. D. 1832.
- 66 constant quantity you subtract furthermore the value of a for each year, and of S for each
- " century descending, the Sun's mean Longitude due to the time so equated drawn into-
- 66 549 1 will be equal to the Ayanansa for the beginning of the said Solar year.
- "The formula for all years descending from A. C. 1902 (A. D. 1800) to any year not exceeding A. C. 5400 (A. D. 2299), will therefore be

$$T = \beta + 1 day - (SnC + B + ma) - da$$

and for the 19024 (A. D. 1800)

$$T = 3 + 1 = B = dx$$

The Hindu Solar years which concur with those of the XVIIIth century, may all Le equated by means of the first or general formula,

$$T = \beta + SuC + \Delta + ma - dx;$$

but the same may be done by means of the following special formulæ.

### PROPOSITION IV.

"If to the commencement of the 4803 year of the Call yug (A. D. 1701) you add one orthograms, and the control of the Call years.

ble ume. Not exceeding A. C. 1300 complete, A. A. C. 1501.

descending from A.

Special for all years ascending from A. Call 4500, A. D.

1709, to any assigna-

Special for the year A. D. 17v1 caly .

\* day and 2' 47',66 (1' 17",1 European time) x, the result will be the same as in the foregoing

" propositions, and the formula for that particular year will be

$$T = \beta + 1 + y - dx.$$

# PROPOSITION V.

Special for all years from A. Cal. 4804 to 4901, A. D. 1752 to 1799.

"If from the commencement of the 4804th year of the Cali yug (A. D. 1702) you subtract the constant quantity 1° 36°,03 (24°,2 European time E; and if for the remaining years down to A. C. 4901 (A. D. 1799) you subtract furthermore the value of a for each year descending, the results will be as before stated, and the formula

$$T = \beta + 1^{\text{day}} - (E + ma) - dx.$$
Observation.

The limits in Propositions III and IV explained.

explained.

Case where the Hindu, is supposed to proceed in a contrary direction from the European, pre-

It will have been remarked in Proposition III, that the rule answers no higher than the 1800th year of the Cali yug complete (A. A. C. 1301); and in Proposition IV, no lower than the 5400th Cal. complete (A. D. 2293), whereas at Proposition I, it is extended up to A. C. 5601 (A. D. 2500) complete, or the beginning of the 5602d; and that no limits were fixed for ascending years, but the restrictions at Propositions III and IV proceed, from the supposed Epicircular, or Libratory motion of the Equinectial points, which are only retrogade in the 2d and 3d Quadrants of the Ayanansa, and consequently progressive in the two others, so as to return in a contrary direction towards zero.

But although we should use the Ayanansa Table for finding the Longitude of the 1st point of Mesha 7 on the beginning of any Solar year, according to the error cous notions of the Indians, yet as the Hindu difference of the true and supposed Longitude is always equal to double the quantity of precessional variation (Cranti-Patagati) due to the interval elapsed between the passing of Excither into the 1st Quadrant, in ascending, or into the 4th in descending years, having established that constant ratio, the formula will still hold good.

For let the Ayanansa for the 1599th year of the Cali yug complete (A. A. C. 1100) be by the Tables (and according to Hindu theory)  $23^{\circ}$  59' 6"; say from 1800 to 1599 there are 201 years, for which the motion of the Equinoxes is  $201 \times 54^{\circ} = 200 \times 54^{\circ}$ 

The double of which
Added to the supposed Ayanansa
Gives the true Hindu Longitude sought

1 0 0 54

to which the time equated by the formula will correspond.

#### SECTION I.

### EXAMPLE 1.

Let it be required to compute the time at Paris when the Sma's mean Longitude is equal to the

Ayanansa on the beginning of the Hindu Solar Sydereal year 4802 of the Califying, answering to Examples for Hindu A. D. 1700, a Bissextile year O. S.

Solar years cereur. ring with Christian Secular years O. S.

The formula in the present case is (page 253.)

$$T = \beta + 1 day + A - dx$$
. (Froposition II.)

C:li vuz 480?, A. D. 1760 Secular,

Time of commencement of the Solar year 4802 expounded in the usual manner.

Subtract, to count from noon, II 29 12 42 52 Longitude in time between Paris and Lanca, L. - 4 54 12 Equated time uncorrected, 29 7 18 40 March

when the Sun's mean Longitude is equal to the Ayanansa such as given in Table XXXVI, and will be found to be 18' 1' 19",9 which drawn into  $\frac{54"}{54*1'15"}$  = 18' 0' 53',3.

Ayaransa ard Lone gitude of the first point in Mesha Y 150 0 54".

40"

In order to save the trouble of the latter operation, say

and the time which the Sun will take to move through that number of seconds (Table LII) is 10'31", which subtracted from March

Leaves the true equated time 
$$T = March$$
 . 29 7 38 9

at which time the Sun's mean Longitude (at Paris) will be found equal to the Ayanansa, as may be computed thus:

From 1st January to 29th March 89 days; but as the Sun's mean Longitude for 1700 in Table LII is given for noon 1st January (on account of the Bissextile), take only for 88 days.

|                      |         |                  |     |     | • | •  | ,  | 4     |
|----------------------|---------|------------------|-----|-----|---|----|----|-------|
| O's mean Longitude I | Table l | LII, 1st January | 170 | 0 - | 9 | 20 | 57 | 51    |
| For 80 days, part 2d | -       | •                | -   |     | 2 | 18 | 51 | 6,4   |
| 8 do. do.            | •       | •                | •   | _   |   | 7  | 53 | 6.6   |
|                      |         | 7 hours          | -   |     | • |    | 17 | 14.9  |
|                      |         | 30 minutes       | _   |     | - |    | 3  | 13,9  |
|                      |         | 8 minutes        |     | -   | - |    |    | 1 9.7 |
|                      |         | 9 seconds        | -   |     | - |    | -  | 4     |
| Sun's mean Longitude | cqual   | to the Ayanansa  |     | •   | 0 | 18 | 0  | 52,9  |

differing only 1",1 from that given in Table XXXV.

N. B.—The same calculated by Delalande's Tables gives exactly 78° 0' 54".

<sup>(\*)</sup> Generally dx is subtractive when the Longitude given by Table XXXVI, is greater than that by Table XXXV, and vice versa.

٧.

### SCHOLIUM.

| According to the Hindu Kalen-                                                            | To count from noon, subtract         | 23 46 40 0 from © rising.<br>— 15 |
|------------------------------------------------------------------------------------------|--------------------------------------|-----------------------------------|
| dar the Sun is supposed to have entered the sign Mesha $\gamma$ on the                   | Hindu time                           | 28 31 40 0 p. m.                  |
| 28th March 1700 at 12th 40' p. m.                                                        | European time                        | 23 12 40 0 p. m.                  |
| Meridian of Lanca (19); but according to European computation, he only entered it on the | 2º Equated time To reduce to Lanca - | n. ' * 29 7 38 9 p. m. + 4 54 12  |
| 29th of the same month at 12h                                                            | True time Time as above              | 29 12 32 21<br>23 12 40 0         |
| 32'21" also at Lanca; i. e. 23" 52' 21" later: during which                              | Error in time                        | 0 23 52 21                        |

time the Sun would move through an Arc of 58' 51",4. It follows therefore, that the Hindu Kalendar advances too much the Sun's position, since it assigns it 12° 0° 0' 0" when it is only 11° 29° 1' 8',6. Hence the correction of the Hindu Tables should be subtractive from the Ayanansa. or additive to the time.

### EXAMPLE II.

Cali yug 4902, A. D. 1800 Secular.

Ayanaasa and Longitude of γ 19° 39'

Let the same be proposed for the beginning of the 4902d year of the Cali yug, answering to A. D. 1930, being (according to the Julian Kalendar) a Bissextile year. (\*)

The formula is  $T' = \beta + 1 - B - dx$  (Proposition III).

| Ayanansa.                          |            |                |    | G.         | ٧.  | P.                |
|------------------------------------|------------|----------------|----|------------|-----|-------------------|
| By Table XXXV, 19 30 54 0          | ß =        | March          | 29 | 38         | 45  | 0                 |
| do. XXXVI, 19 21 21 6              | + 1        | •              | 1  |            |     |                   |
| Difference 27 6                    |            |                | 30 | <b>3</b> 3 | 4.5 | 0                 |
| Answering to 11' 0' of time = dx.  | B          | •              |    | 7          | 12  | 52                |
|                                    | In Hind    | u time         | 30 | 31         | 22  | 8                 |
|                                    | In Euro    | pean time      | 3) | 12         | 36  | 51 from O rising. |
| Subtract, to count from            |            |                |    | 6          |     | 0                 |
|                                    |            |                | 30 | 6          | 35  | 51 p. m.          |
| Longitude in time between Paris an | d Lanca -  |                |    |            | 51  |                   |
|                                    |            |                | 30 | 1          | -   | -                 |
|                                    | _          | _ d <b>x -</b> |    |            | 11  | 0                 |
| Equated time, Meri                 | dian of Pa | nris, T =      | 30 | 1          | 31  | 39 p. m.          |

<sup>(\*)</sup> Not to repeat uselessly the same words, the time of commencement of the Hindu Solar Sydereal year, represented by \$\beta\$, will be supposed known. (Vide 1st Memoir.)

The process for finding the Sun's Longitude by the European Tables, or Table LII of this collection, being the same as in the preceding Example, need not be repeated. It gives 19° 30' 54", 2, differing only by 0',2 from the Ayanansa.

### EXAMPLE III.

The same for the commencement of the Solar Sydercal year 3102 of the Cali yug, answering to A. D. O.

The formula is  $T = \beta + 1 + SnC + A + dx$  (Proposition II), and in this case as the Aya. nansa is negative, being in its second Padah, the difference of its Supplement to 12 Signs (or Longitude according to European expression) is to be taken for finding dx,

Cali vug 3102, A. D. O becular.

T. Equated time, Meridian of Paris, March 16 15 35 34

As the Epoch of this Example is very remote, I shall subjoin the computation of the Sun's Longitude by means of Table LII.

From the beginning of the European year to the 16th March, 76 days: but as the proposed year Long. 11 22 30 54 is Bissextile, take for 75 days.

| Table LII, O's mean Longitude 1st January A. D. O | •   | 9 7   | 5 <b>7</b> | 5     |
|---------------------------------------------------|-----|-------|------------|-------|
| do. part 2, for 70 days .                         | •   | 2 8   | 59         | 43,1  |
| 5 do                                              | •   | -1    | 5 <b>5</b> | 41,6  |
| 15 hours •                                        | •   | •     | 36         | 57,7  |
| 30 minutes                                        | -   | -     | 1          | 13,9  |
| 5 do. •                                           | •   | -     |            | 12,3  |
| 30 seconds                                        | •   | -     |            | 1,2   |
| 4 do                                              | •   | •     |            | 0,2   |
|                                                   |     |       |            | ····· |
| Sun's Longitude by the European Tables            | 3 - | 11 22 | 30         | 55,0  |

differing from the Supplement of the Ayanansa by 1".

<sup>(\*)</sup> In the first and second Padah of the Ayanansa, the Sun's Longitude on the 1st. Valsacha, is its Supplement to 12 Signs. In the third and fourth the Ayanansa and Longitude are the same,

SCHOLIUM.

By the Hindu Kalendar, the Sun is supposed to have entered the sign Mesha γ on the 13th March A. D. O, at 18° 30′ p. m. at. Lanca (1°), and the Sun's Longitude in the Tropical Ecliptic was 11° 22° 30′ 54″ on the 16th of the same month at 20° 29′ 46″ p. m. also at Lanca, by the European Tables (2°). The difference in time is therefore 3° 2° 0′ 14″, during which

the Sun would move through 3° 2′ 21" (Table LII, part 2), and as the Hindu Kalendar supposed the Sun to have 12' Longitude, three days, &c. before he was actually thus much advanced in the Ecliptic, it follows that the error of the Hindu Tables is subtractive of the Longitude and consequently additive to the Ayanansa, as well as to the time registered in the Kalendar.

### EXAMPLE IV.

Caliyng 5102, A. D. 2000 becular,

The same for the commencement of the 5102' year of the Cali yug, answering to A. D. 2000, a Bissextile year.

The formula is  $T = \beta + 1 day - (SnC + B) - dx$ . (Prop. III.)

OPERATION.

2000 nC = 2 B = 7° 20° 4°

1800

Ayanausa.

Table XXXV, 22° 30′ 54°

do. XXXVI, 22 31 25,2

Difference 31,2

The time due to which is 12′ 15″ = dx.

S = 
$$7^{\circ}$$
 20° 4°

X 2

March 31 18 24 43 p.m.

April 1 22 55 0

-SnC + B = 21 53 0

March 31 18 24 43 p.m.

-L - 4 54 12

SnC + B = 21 53 0

-dx - 12 15

Equated time at Paris, T = March 21 13 18 21 p.m.

and whether we resolve the Sun's mean Longitude by Delalande's Tables, or Ly Table LII, we shall find it to be 22° 30′ 54″,8, differing from the Ayanansa (which is also the Longitude of the 1st point in Mesha) by 0″,8.

The error of the Kalendar may be deduced in the same manner as before.

Ayaransa and Longitude 22° 30′ 54".

### SECTION II.

Examples for Hindu Solar years, corresponding to European Julian years which are Bissextile without being Secular.

### EXAMPLE V.

Let it be proposed to equate the commencement of the 47821 year of the Cali yug, answering to A. D. 1680.

How to equate the commencement of Hirdu Solar years concurring with Christian Bissextiles not Secular.

Cali yuz 4782, A. D. 1680 Bissextile.

The formula in this case is 
$$T = \beta + 1^a + (SnC + A + ma) - dx$$
. (Prop. II.)

Operation.

Time equated, Meridian of Paris, T = March 29 4 3 56 p. m.

O's Longitude 1st January 1600, Table LII, part 1, div. 2, 9 20 11 56 div. 3, 80 years, 36 44,53

Part 2, for 88 days, 4 3 56 (d. 1, 2, 3 and 4), 2 26 51 14,2

O's mean Longitude, differing only from the Ayanansa by 0',73, 0 17 42 51,73

Ayanansa and Longitude 17° 42' 54".

#### EXAMPLE VI.

The same for the commencement of the 4918th year of the Call yug, answering to A. D. 1816, A. D. 1816, Bissextile.

Formula  $T' = \beta + 1 \, 1^d - (SnC + B + mb) - dx$ .

OPERATION.

1816

1800

$$nC = 0$$
.  $m = 16$ .  $mb = 16 \times 424^{\circ}, 04 = 1210^{\circ} 24^{\circ}$ 

-27.26 which answers to 11'8" of time  $\pm dx$ .

do. European time 30 15 28 41 from © rising.

— H

— 6

— 30 9 28 41 p. m.

— L

— 4 54 12

Ayananca and Laugitude 19° 45' 15". ©'s mean Longitude 1st January 1800, Table LII, 9 21 43 47

Part 1st, do. for 16 years 7 20,9

Part 2d, for 89 days, 4 hours, 23 minutes, 21 seconds 2 27 51 10,2

©'s mean Longitude at equated time 0 19 45 18,1

differing only 0",1 from the Ayanansa.

1700

The foregoing six Examples provide for every case of Hindu Solar Sydereal years corresponding to Christian years which are either Secular or Bissextiles. As for the common years the rule is the same, observing that in ascending years from A. D. 1700, the term m a of the first formula, applies to the number of years counted from the end of the century giving the years which are wanting to complete it; and m b of the second, to the number of years counted from the beginning of A. D. 1800 to the proposed one. I shall give a few Examples of the case of Hindu Solar corresponding to common European years, for the purpose of shewing how the Sun's mean Longitude according to European Astronomy, is to be computed by means of Table LII. (\*)

# SECTION III.

Examples for Hindu Solar years which correspond with common Christian years before and fter Christ.

Example for a year after Christ, before Christ.

A. C. 3101. A. A. C. 1. B. C. and common. EXAMPLE VII.

Let it be proposed to equate the commencement of the 3102d year of the Cali yug, answering to A. A. C. 1 current, a common year.

It will be found by Table VIII (page 10 of the Tables), that the Initial Root for that year is Friday, at 45° 43° 45° after Sun rise; and by Table V, part 3d, that this Friday falls on the 14th March, which gives the value of  $\beta$  in the formula  $T = \beta + 1 + (SuC + A + ma) + dx$  (Prop. II).

Ayanansa.

7 20 0
12s 0 0 0

Long, 11 22 20 0

OPERATION.

<sup>(\*)</sup> The author begs here to remind the reader, that he is not writing for the purpose of instructing Astronomers, but merely to give to those who are not, the means of using his Tables and Formulæ,

which rule differs in no respect from the preceding; but in order to find the Sun's mean Longitude by means of Table LII, which is the same as that deduced from the Avanansa, we are to proceed as follows:

which differs only from that deduced from the Avanansa by 0°.5.

### EXAMPLE VIII.

The same for the commencement of the 4743d year of the Cali you, corresponding to A. D. A. C. 4743, A. D. 1641 cammon. 1641, a common year.

Formula 
$$T = \beta + 1 + (SnC + \Lambda + ma) - dx$$
 (Prop. II.)

#### OPERATION.

Avanansa and Longitude. As this case offers nothing new, I shall be contented with Avanarea and Lonstating that nC = 0; m = 50; ma = 4 19 38; SnC+A+ Table XXXV, 17 7 48 0 do. XXXVI, 17 8 11 46  $ma = 4^{\circ} 26^{\circ} 50^{\circ}$ ; dx = 9' 34''; and  $\beta$ , by the usual process, difference \_\_ 23 46 being found to answer to March 28th, 50° 55' 15", the time answering to 9' 34" of time.

citude 17° 7/48".

after noon equated to the Meridian of Paris is March 29th, 3' 5' 28', at which time the Sun's true Longitude by Delalande's Tables, or Table LII, will be found as follows:

#### SECTION IV.

On the manner of equating the beginning of Hindu Solar years concurring with those of the XVIIIth Christian century.

We have already observed (page 253) that the term A of the first formula (7,12) applies to Solar years concurring with all Christian years ascending from A. D. 1700; and that B, of the second formula (7. 12. 52) to those corresponding to all Christian years descending from A. D. 1800. We are now to consider the resolution of that part of the problem, which equates the commencement of Sydereal years from the 4802 to the 4902 of the Cali yug, corresponding with

How to equate the beginning of Solar years. concurring with those of the 18th Christian ceathose of the European XVIIIth century; the mode of doing which differs only in appearance from the rest, for every thing still depends on the Secular Equation S = 7° 20° 4° and its fractions. The formula however, changes, as we have seen at page 254, and this is to be ascribed to the Signs passing from + to - during that interval, although if we were to begin from that Epoch where S, A, and B = 0, such a change would not occur, as shall be seen hereafter.

N. B .- It is to be remembered, that A is only equal to 7' 12"; and B to 7' 12' 52' at the end of the 4801st and 4901st of the Cali yug. The passage from A to B will be explained in what follows:

which is the Equation for 4903 complete, answering to A. D. 1702; from which year the Equation becomes negative. I shall therefore call the year 4804 current of the Cali yug, answering to A. D. 1702, the Epoch of the years concurring with those of the XVIIIth century, and its Equation E = - 1 36P.08; that for the beginning of A. Cal. 4803 (1701) remaining peculiar to itself, viz.  $+2^{\circ}47^{\circ},96 = y$ . (Proposition IV).

The Equation for 4803 unique.

Cali yng 4804, A. D. 1702, Epoch for

the Solar years con. curring with those

of the XVIIIth century.

> The above considerations will lead us to determine the value of B for the Solar year concurring with A. D. 1800; for let us find the Equation for the commencement of the 4901st year of the Cali vug, answering to A. D. 1799.

The values of E and Y referred to that of B in the 2d formula.

| From the proposed year                                | <u> </u>                                |
|-------------------------------------------------------|-----------------------------------------|
| Subtract Epoch                                        | 1762                                    |
| Now multiply a (4' 24',04)                            | 97 years = m.<br>4 21,01<br>by m = × 97 |
| Add E (2bove found)                                   | 7° 6 51.83<br>+ 1 36,08                 |
| Equation for 1799 To which add again a for one year - | 7 8 27,96<br>+ 4 21.04                  |
| Equation B, for 1800                                  | 7 12 52,0                               |

This being understood, so will the formula

Case unique, A. C. 4803, A. D.

1701.

 $T' = \beta + 1 - (E + ma) - dx$ . (Proposition V), for all the years of the Hindu account which concur with those of the XVIIIth century, except the 4303d of the Cali yug (1701), which retains its own Equation + 2' 47',96 = x.

> SECTION V. EXAMPLE IX.

We shall first resolve the case of the beginning of the 4803d year of the Cali yug, answering to A. D. 1701, which, as already stated, is unique of its kind, the Equation being

 $T''' = \beta + 1 + x - dx$ . (Proposition IV.)

Formula for Solar years from 4804 to 4902.

Ayanansa and Longitude. G. T. P. March 29 2 11 15  $\beta =$ Table XXXV, 18 1 48 1 do. XXXVI, 18 2 13,9 2 47,96 x Difference 25.9 30 2 14 2,96 Answering to 10' 31" = dx. 0 53 37,2 from @ rising. - H 29 18 53 37,2 p.m. -- L 4 54 12 29 13 59 25,2 --- dx 10 31 29 13 49 51,2 p.m. Time P. M. equated to Meridian of Paris, T'

And for the O's Longitude due to that instant according to the European Tables, we have

Longitude and Aya-

Table LII, part 1, ⊙'s mean Longitude 1st January 1700 - 9 20 57 51

For one year, division 4, + 11 29 45 40,5

⊙'s mean Longitude 31st December 1699 - 9 20 43 31,5

Same Table, part 2, for 88d 13h 49' 54" - 9 20 7 18 18,1

⊙'s mean Longitude sought - 0 18 1 49,6

differing from the Ayanansa on the beginning of A. Cm. 4803, by 1°,6, which is the maximum of deviation which has occurred in the course of this research, even for the remotest times, between the results of the formulæ, and those of the European Solar Tables.

### EXAMPLE X.

The same for the commencement of the 4804 h year of the Cali yug, concurring with  $\Lambda$ . D. 1702. Formula  $T = \beta + 1 - (E + ma) - dx$  (Frop. V.)

Cases for the remaining years of the ceatury.

Here, as the proposed year is that of the Epoch (page 262) m and ma =0, and E+ ma=1' 36',08.

A. C. 4804, A. D. 1702, a common year,

Answering to 10' 10" of time = dx.

 $\beta = \frac{\text{March } 29 \ 17 \ 42 \ 30}{+ 1 \ day} - \frac{1}{1}$   $- E + ma - \frac{1}{1} \ 36 \ 36 \ 36$ 

Hindu time, March 30 17 40 53.9

European time 30 7° 4′ 20″

— H - 6

30 1 4 20 p. m.

— L - 4 54 12

29 20 10 10

— dx - 10 10

Avanansa and Longitude 13° 2' 42".

Equated time, Meridian of Paris, T . 29 20 0 0 p. m

And for the European Tropical mean Longitude.

differing only 0",1 from the Ayanansa.

### EXAMPLE XI.

A. C. 4559, A. D. 1748.

Ayanansa and Lengitude 18' 44' 6' a Bissextile year, The same for the 4850th year of the Cali yug (A. D. 1743).

The formula being the same in all such cases, we have m = 46;  $ma = 46 \times 45$  24v,04 = 3g 22v 25p,8; and E+ma = \_ 3g 24v 1p,88. Hence

and the O's mean Longitude for that time by Table LII, will be found 18° 44' 6",8.

The eleven preceding Examples provide for every possible case that can be proposed for any time past or to come; but there remains to shew the derivation of the various formulæ hitherto used, from the general one given at page 250, and this will be done by means of three Propositions, which are only introduced here for the sake of demonstration, their object being to trace the time when the terms S and a of the formulæ become equal to zero.

#### SECTION VI.

### Proposition A.

The Equation for the beginning of A. C. 5602 is 1g 26v 40p =  $\triangle$ . A. D. 2500 the Epoch referred to.

"you add 1° 26° 40° (34' 40° European time)  $\Longrightarrow \triangle$ , and reduce the same to noon under the Meridian of Paris, the Sun's Longitude due to that instant, as given by the European Tables,

" will be equal to the Ayanansa for that year as computed by the Hindu rule." (Proposition I.)

### PROOF.

The beginning of A. C. 5602 as elicited by the rule given at page 8 of this collection, falls on Wednesday at 43s 20v Op after Sun rise at Lanca, and for the monthly date of the initial feria, we have by Tables V and VI, parts 1, Wednesday, 4th April, Julian style, therefore

Formula  $T = \beta + SnC + \Delta + ma - dx$ , where SnC = 0; ma = 0. Ayanansa and Longitude. R = April 4 43 20 0Table XXXV. 1 0 0 54 1 0 1 35 41 do. XXXVI, Hindu time 4 44 46 40 41.6 Difference — 41 41 Answering to 16' 52' in time == dr. H. 4 17 54 40 from O rising. - H 4 11 54 40 p. m. - L 4 54 12 7 0 28 -- 16 53

For the Sun's mean Longitude according to the European Tables, we have (the year being a name la. 0° 0' 54° leap one),

Time equated to Meridian of Paris, T = April 4 6 43 35 p. m.

A. C. 5602, A. D.

2500.

differing only by 0°,2 from that produced by the Hindu rule.

#### Proposition B.

"If to the foregoing constant Equation 1s 26v 40p =  $\triangle$ , you add the value of S (7s 20v 4p) for each century ascending from A. C. 5602, and to the sum you add the time of commence." ment of the current Tamul year, the Sun's Longitude due to the time so equated will be equal to the Ayanansa." (Proposition I).

### Proor.

Let the commencement of the 5102<sup>a</sup> year of the Cali yug, answering to the Julian Secular year 2000, be proposed. Then by the present Proposition,

$$\delta uC + \Delta = S$$
.

from 5502 where nC according to former subtract 5102 notation = 5, and S = 7 20 4 remains 
$$(5)00$$
 nC  $\times$  5 36 40 20 To which add proposed Equation  $\triangle$  + 1 26 40 Equation due to A. Cm. 5102 = E 38 7 0

A. C. 5102, A. D. The beginning of the 5102d year of the Cali yug, as we have seen at page 253, Example IV, is

For the term dx, see Example IV, where it is equal to - 31",6, answering to 12' 15' of time.

Ayanansa and Longitude 22° 30' 54".

and this result being precisely the same as that found at Example IV, needs no further verification.

E always referrible to + SnC+A or - SnC+B of the former formulæ,

So that when in Example IV we added 1 day and subtracted 215 53°, we did precisely the same thing as in the present operation, when we added at once the said difference.

And in the same manner, if the 31021 year of the Cali yug were proposed, 5602

nC would be equal to (25,00

and SnC - S - 7 20 4

nC - 
$$\times$$
 25

SnC = - 3<sup>4</sup> 3 21 40

To which add  $\triangle$  = - 1 26 40

Equation E - 3 4 48 20

General for all years ascending from A. C. 5602, A. D. 2500.

which is precisely the same as was found at Example III, page 257, = 1<sup>a</sup>+SnC+A, and therefore requires no further illustration.

Thus it was that we found the formula

$$T = \beta + SnC + \Delta + ma + dx$$

given at page 250, of the expounding of which I shall give another Example.

### EXAMPLE XII.

Let the 4804th year of the Cali yug (A. D. 1702) be proposed.

A C. 4804, A D.

2500  
1702 Then nC = 7. m = 98. SnC = 7. 20' 
$$4^{\circ}$$
X7 = 515 20' 23P, and ma = 7. 798  $98 \times 4^{\circ}$  24',04, = 75 11' 15P,9.

Therefore

which is the same Equation as that which was used at Example XI, page 264, and therefore the rest of the operation need not be performed.

Lastly, we are to determine the precise time when S and a will become = 0, on which occasion we shall observe, that as this Epoch probably falls on a broken period of the year to which it refers, the term a, which is the variation for one whole year, will exceed that which may be due to the commencement of the Solar year in the course of which it vanishes; a must therefore be transformed into  $\frac{a \times D}{300}$ , where D represents any number of odd days expired of the year,

Transformation of a for broken periods of years into  $\frac{a \times D}{365}$ 

### PROPOSITION C.

The precise time when S and a are equal to 0, falls on the 15th December A. D. 2519, Julian style, (29th Gregorian style), at 18<sup>8</sup> 53' 14" p. m. under the Meridian of Paris, or 253d 18s 17v 17p after the commencement of the Hindu Solar year 5621 of the Cali yug, at Lanca.

Resolution of the Epoch when 5 and a = 0.

As the value of m a on the beginning of the Solar year 5602 (A. D. 2500) was found to be 15 26v 40p, the time when it will be equal to zero is determined by this expression  $\frac{\lg 26v 40p}{4v 24p,04} = 19$  years, 2534 185 17v 17p, and as we have now only a fraction of a on the beginning of the Hindu year, the formula will become  $T = \beta + \frac{a \times D}{365}$  — dx, where D = 253 days in the present case, to expound which we have by Tables VII and I,

Special formulawhere  $\frac{a \times D}{30s}$  is positive.

33

13

13

10

Initial root for the year C. 5602

which accounts for 19 years. And for the fraction 253d 18g 17v 17P, the
Supplementary Table LII, part 2, shews that there are 246 days expired at
the end of Margasiras: taking therefore the collective root for the said time
out of Table III, we have

(\*) (1)

Margasiras.
253
Table LII - 246
Paushia 7th

Initial root of the month Paushia

To which add root for 7d 18s 17v 17p

(0) 56 50 55

(†) (0) 18 17 17

Root at the given instant

(1) 15 8 12

Monday.

which feria being expounded by means of the Dominical Letter E, Julian style, (Tables V and VI) will be found to fall on the 15th December A. D. 2519.

Here it is to be observed that we have added to the commencement of the

Hindu Solar years, the two following fractions of roots, viz.

(\*) 18 37 10
(†) 18 17 17

Sum, Hindu time
do. European time

14 45 47 (‡

during which time the Sun's mean motion amounts to 36' 21",7, (±) which are to be taken into the account when we compute the Sun's place by means of the Ayananea; which by

Table XXXV = 
$$\begin{bmatrix} 1 & 0 & 18 & 0 \\ XXXVI = & 1 & 0 & 18 & 42 \end{bmatrix}$$

Difference 42 answering to 7' 4" of time = dr.

As for  $\frac{a D}{365}$  we have 365d : 4v 24p,04 :: 253d (by Prop.) : 3v 3p.

### OPERATION.

For the Sun's mean Tropical Longitude.

By the European and Hindu Solar Tables.

| Ayanansa.                        | ,  |    |           |      | Table LII.                                        |
|----------------------------------|----|----|-----------|------|---------------------------------------------------|
|                                  | 8. | •  | ,         | •    | a. • * *                                          |
| 1st Vaisacha A. C. 5621,         | 1  | 0  | 18        | 0    | Sun's mean Longitude 31st Dec. 2519, 9 26 29 33.7 |
| 200 days, Table LII,             | б  | 17 | 7         | 46   | do. 348° or 14th December 2519 - 11 13 0 18,0     |
| ao.                              | 1  | 19 | 16        | 56,5 | 18 hours 44 21.2                                  |
| 3 do.<br>do. for 14' 45' 47' (‡) |    | 2  | <b>57</b> | 25,0 | 53 minutes 2 10,6                                 |
|                                  |    |    |           | 21,7 | l⁴ seconds 6                                      |
| Sun's mean place                 | 9  | 10 | 16        | 29,2 | 9 10 16 29,1                                      |

The difference of which results is insensible.

There remains now only to shew, that S and a will change Signs from the 14th December 2519 Julian style, which will be proved by the following results.

Let the beginning of the 5622d year of the Cali yug (A. D. 2520 a Bissextile) be equated.

The formula will be  $T = \beta = \frac{a \times D}{365} - dx$ , where D represents the number of days that remained from the 14th December 2519 to the end of the Hindu Selar year 5621; for which observing that this expression in the last Example was

If you subtract the same from a 
$$=$$
  $=$   $=$   $=$  3 3  $=$  4 24,04 You have  $=$   $=$   $=$  1 21,04 its value for the present case  $=$   $=$  1 21,04

Ayanansa, 1st Vaisácha, Cali yug 5622. Table XXXV, 1 0 13 54 do. XXXVI, 1 0 19 35

> Difference 42. dx therefore remains as before = 17' 4".

Apanansa and Longitade is, 9' 18' 54". OPERATION.

Initial root, preceding Example.

which expounded in the usual manner with the Dominical Letters DC, shows that the initial feria Sunday, falls on the 4th of April 2520 Julian style. Therefore

And for the Sun's mean Longitude at the equated time by the European Tables,

which differs only by 0",3 from the Ayanansa due to that instant.

Epoch when S a change Signs.

A. C. 5622, A. D. 2520.

Special formula  $\frac{a \times D}{a}$  is negalive.

Thus we have proved by the result of many operations, the correctness of the formula  $T = \beta \pm (8nC + m a) \pm dx$ , given at page 250. An analytical demonstration of the same would no doubt have been more scientific; but it was observed by a learned Gentleman, to whose judgment this paper was submitted, that as the Kala Sunkalita was principally intended for the instruction and use of persons little versed in the higher branches of the Mathematics, Examples were the best mode of demonstration; and to his opinion we have submitted our own. There remains now to show the application of our formulae to the resolution of questions, which depend on the Sun's position in the Hindu Sydereal Ecliptic, at a given instant of time, which to resolve by other means would involve the computer into long and delicate calculations.

FIRST CASE. (\*)

Vestiges of the date clared! Inscription exponeded.

A. C. 3644 under the government of N. Sun's apparent Sydereal Longitude III 4° 29' 47". On an old Inscription much defaced by time, there remains no other vestiges of the date of the event which it was designed to commemorate, but that of the current year 3644 of the Cali yug, with the name of the year of Jupiter's cycle corresponding thereto, viz. Calayacta (the 52d), both answering to the 465th year Saca, or from the birth of Salivahana, and the name of the Prince N, who reigned at that time; and lastly, the Sun's apparent Longitude in the Hindu Sydereal Ecliptic on the day of the event, which is stated to have then been in 4° 29′ 47″ of the Solar Sign Vrischica m.—Q. What was the Hindu Solar Sydereal date answering to that position of the Sun, and also the concurrent European date?

As the Sun's Longitude recorded on all public monuments is generally his apparent one, the first operation consists in deducing the *mean* from the apparent Sydereal Longitude proposed, being that to which the formulæ answer; and this is to be effected by means of several of the Tables contained in this collection, and by the following process.

The Christian year is expounded in the usual manner, 3644 - 3102 = 542 Julian Kalendar, and as the Sign Vrischica M is the 5th of the Solar Sydereal Ecliptic, our Longitude is to be expressed 7' 4° 20' 47".

To deduce the Sun's mean from his apparent Longitude.

In order to deduce approximatively the Sun's mean from his apparent Longitude, we shall first use the latter as if it were his mean place for finding the corresponding Anomalistic Equation, which will be done by means of Tables XXII or XXIV, and XXVII, part 2d.

As the latter Table supposes the Sun's Apogee in 2° 17° 17′ 20″, which will be its place at the end of the 4910th year of the Cali yug, and as we want it for the 3643°, we are to correct the Apogee for 1267 years, for which (its motion being 1′ in 517 years), say 517°: 60° :: 1297°: 2′ 30° the Equation sought: which being additive in the 1st and 3d Quadrants, and subtractive in the 2d and 4th Quadrants of Anomaly (agreeably to the construction of Table XXVII), is in the present case to be subtracted.

<sup>(\*)</sup> The date of the Inscription is assumed.

Now the Sign Vrischica m answers to the Solar month Margasiras (Tamul

Cartiga), on the first day of which the Sun's distance from his Perigee

is (Table XXVII, part 2)

Subtract correction

Distance from do. 1st Margasiras

1 17 14 50

But as by the Inscription the Sun was advanced 4° 29' 47" in the Sign Vrischica m, and because he is advancing towards his Perigec, that Arc is to be subtracted from s. ' ' 1 17 14 50 

the above - - - - - - 4 29 47 

Sun's distance from Perigee, called Manda Kendra 1 12 45 3

The Argument of the Sun's Assumaly.

which is the Argument of his Equation; therefore, with 1° 12° 45′ 3′ referring to either Tables XXII or XXIV, we find the same to be 1° 29′ 20″; and because in Table XXVII, the negative Sign (—) is affixed to the month Margasiras when the apparent Longitude is sought, it is to be added in the contrary case. Hence

Proposed apparent Longitude
Ravi Phala
O's approximate mean place

8.
7 4 29 47
+ 1 29 20
7 5 59 8

Sun's mean Sydereal Longitude 7s. 5° 589

With which in such matters, one might very well be contented: but if more accuracy were required, as this mean Longitude would give an apparent one 2' 34" too great; on a second trial, which need not be exhibited, the exact mean Longitude sought would be found to be 7' 5° 56' 37".

In order to simplify what remains to be shewn in this Example, I shall suppose that the mean Longitude deduced from the apparent one was in round numbers 7° 6°, which is of no consequence, since the difference in the Sun's motion falls considerably below an entire day.

Sun's mean Sydereal Longitude assumed 7s. 6°.

If we compute the Ayanansa due to the commencement of the 3644th year of the Cali yug, either by the rule exhibited at page \$4, or by Table XXXV, it will be found = 38′ 42°

Ayanansa - 138' 42"

Sun's Hindu mean Tropical Longitude 7s. 6 38 42".

or mean Hindu Tropical Longitude, deduced from Proposition, the error of which we are to calculate before we can determine the European date of the recorded event.

For the time of commencement of the 3044th year of the Cali yug.

By Table VII, Epoch A. D. 500 (0)57 11 15 Table I, for 40 years (1)20 50 0 2 do. Do. 15 31 15 Initial root sought (3) 32 13 Soota dina Wednesday.

The beginning of the Hindu Solar year expounded into its corresponding European date.

For expounding this feria, if we proceed as indicated at page 23 and the following, and by help of Tables V and VI, we shall find that the Dominical Letter for A. D. 542 is E, and by the limits given in Table V, part 1st, that the Wednesday under consideration falls on the 19th March: with this we have the necessary data for correcting the Sun's Hindu Longitude.

19th March A. D. 542.

Expounding the time of beginning of the year for finding the error of the Hindu Longitude.

#### OPERATION.

1700
542
nC = 11. m = 53. SnC = 1d 20g 40v 44p. ma = 4g 15v 14p.

(11)58
$$A = 7v 12p, \text{ and SnC} + A + ma = 1d 25g 3v 10p.}$$
Formula T =  $\beta + 1^{4} + (\text{SnC} + A + \text{ma}) = dx$  (Prop. II.)

When the Sun's mean Longitude by the European Tables will be found as follows:

differing only from the Ayanansa above found by 0",2.

Now by the Hindu Kalendar, the Sun is supposed to have entered γ on the 18th March A. D. 542, at 23° 25′ p. m. (1°); but according to the European Tables, that Longitude was only due on the 21st of the same month at 9° 25′ 56″ p. m. also at Lauca (2°), the error of the Hindu Tables is therefore 2° 10° 0′ 56″; during which time the Sun would move through 2° 22′ 57″,5 of his Orbit, by which Arc

6. V. P. 19 13 32 30 from @ rising March \_\_ 15 Hindu time 18 58 32 30 1s 23" 25' 0" p. m. 20 H. March 21 4 31 44 p. m. 4 54 12 9 25 56 p. m. 18 23 25 Error in time 2 10 0 56 do. in degrees - 2° 22' 57',5

Free of the Hindu Longitude in true 2d 10h 0 56", in degrees 2º 22 51",5.

| the Hindu Tables make his Tropical Longitude too great, as well as the Ayanansa, at the begin- |                                            |
|------------------------------------------------------------------------------------------------|--------------------------------------------|
| ning of the year.                                                                              |                                            |
| From this it results that if from the Hindu Tropical Longitude s.                              | Carrected Tropical<br>Longitude 7s, 4° 15° |
| found at page 271 - 7 6 38 42,0                                                                | 14",5.                                     |
| We subtract the error 2 22 57,5                                                                |                                            |
| We have the corrected Longitude - 7 4 15 44,5                                                  |                                            |
| Expound by the Tubles the time due thereto, viz. 31st s. "                                     |                                            |
| December 511 9 11 36 25,2                                                                      |                                            |
| 9 21 45 5,7 October 23d.                                                                       |                                            |
| 54 12,6 22 hours.                                                                              |                                            |
| 7 4 15 41,5                                                                                    |                                            |
| we have for the true date the 23d October 22h 0' 0".                                           |                                            |
| N. B.—We would have obtained the same result if after having expounded the Hindu Tropical      | True European date                         |
| Longitude by the Tables, which would have given October - 26 8h 0' 56'                         | Meridian of Paris<br>October 23d, 23h.     |
| We had subtracted therefrom the error in time 2 10 0 56                                        | ,,                                         |
| For there remains the same time as before found, October 23 22 0 0                             | True time.                                 |
|                                                                                                |                                            |
| Now this time referred to the Meridian of Lanca, and to that of Sun rising, expressed in Hindu |                                            |
| guddias, &c. is - October 23 22° 0' 0" p. m. Paris.  H - 6                                     |                                            |
| L . 4 54 12                                                                                    |                                            |
|                                                                                                |                                            |
| European time - 24 8 54 12 from @ rising.                                                      |                                            |
| True date expressed in Indian guddias, &c. October 21 22 15 30 at Lanca.                       |                                            |
| For the Hindu Solar monthly date.                                                              |                                            |
| Lastly, as the 1st Vaisacha A. C.li. 3644, fell on the 19th March 542 (page 272) we have from  | For the Hindu Solar                        |
| that date to the 24th October                                                                  | monthly date.                              |
| But by the subsidiary Table LII, part 2, from the 1st Vaisacha to the last day in              | •                                          |
| Cartica there are - 216                                                                        | 4th Margasiras cus-                        |
| There remains in the following month - 3                                                       | reut.                                      |
| which are the number of days expired in Marzasirus. The current Hindu Solar date is therefore  |                                            |

Margasiras 4th, at 22' 15 30' after Sunrise at Lanca. (\*)

<sup>(\*)</sup> Although I have endeavoured to render this Example as clear as possible, yet as from the novelty of the Process, a proof may be required that the result is exact, I shall expound by the usual formula the date now

Nors.

To restore a lost Lpoch.

The name of the year of Jupiter's Cycle being given, how to explain dithe numeral of the corresponding one of the Cabing.

In Bergal they fellow the Shatra account; is the Peninsula, that of the Telingus.

The reign of the Prince whose name is recorded on any document afterds data for the same when known in history.

Or that of any of his known cotemporaries.

When the duration of any reign exceeds 60 years, the question is subject to two answers.

If it so happens that the numeral of the year of the Cali yug 2544, he also obliterated, so that there only remains the name of Jupiter's year, Calayueta the 52d of the Cycle of 60 years, we are to enquire how the Epoch may be restored, and for this we are to attend to the following considerations.

The first point to be ascertained is in what part of India the inscription was found; for if in Bengal, the Chacra year will have been computed by the rule of the Surrich Siddhanta, modified by the Tika; and if in the Pointsula, by that of the Teilingas. In the present case we shall suppose that the inscription was found in Bengal.

We are now to observe that as there is a year of the same name in every Cycle of 60 years, the problem cannot be resolved unless some new data be furnished; but we may find a sufficient one in the name of the Prince or ruler who governed at the time of the recorded event, which is always inserted in the inscription, grant, perwana, &c. that is to be expounded; provided such a Prince or chief be known to Indian history. The time of his birth, of his ascending the throne, and of his death, or the end of his reign, are the limits to be most depended upon. In default of these, the Epoch of some memorable event which may have occurred during his reign, or that of any of his known cotemporaries, or even the time about which he flourished, may be considered as data, more or less to be depended upon, according to their degree of precision.

For although it be not impossible that the same individual should have possessed authority during sixty years of his life (in which case the question would be subject to two answers), yet as the contrary case is the most probable, there can be, in most cases, no very great fear of error when supposing any common reign to have lasted less than that number of years.

obtained; which if it be correct should give the Hindu Tropical mean Longitude deduced from the apparent one found on the Inscription, viz. 7s. 6° 38' 42", (page 271).

Formula  $T = \beta + 1 + SnC + A + ma - dx$ , (Prop. II.)

M. B.—As the value of the terms has been computed at page 251, the same quantities are to be used.

|                                                                                               | β = October<br>and + A + ma = | 24<br>2 | g.<br>22<br>15 | ₹<br>15<br>3 | P.<br>30<br>10 |
|-----------------------------------------------------------------------------------------------|-------------------------------|---------|----------------|--------------|----------------|
| For Sun's Longitude.                                                                          |                               | 26      | 47             | 18           | 40             |
| 31st December 541 - 9 11 36 26,9<br>October 26th - 9 24 42 30,7<br>8h 19 42,8<br>6' 56* - 2,3 | — н                           |         | - 6            |              | 28             |
| Longitude sought - 7 6 33 42,0                                                                | L · ·                         |         |                | 54           |                |
|                                                                                               | - dx                          | 26      | 8              | _            | 16<br>20       |
|                                                                                               | T ==                          | 26      | 8              | ō            | 56             |

which is the same as above.

# EXAMPLE I.

Let it be supposed that N, the Prince whose name appears on the face of the inscription, is known in history; and that he reigned in Bengal between the years of the Cali yug 3601 and 3351: the first step to be taken is, to expound the year of the Chacra which corresponds to the first of these two Epochs; and this will be effected by means of the rule given in the Postscript to the third Memoir, and Table XVIII.

Example according to the account of the Sastras.

By the said Table it appears, that the last expunsed year of the Chacra before the year 3601 of the Cali yug, fell in the 3581st year of the same; answering to A. D. 480

but 3601 current, or 3600 complete, answers to A. D. 499
difference 19

therefore we shall have 28 to add at the end of the rule. (\*) To proceed,

therefore Yuva, the 9th of the Chacra, answers to the 3501st year of the Cali yug current; but from Yuva 9th to Calayucta the 52d, there are 43 years; hence 3501 + 43 = 3644, the same year as that originally found on the inscription.

### EXAMPLE II.

Let us suppose that a perwana was granted by Sevajee, the chief and founder of the Marrahta power, which was dated, among other designations no longer legible, Vicari, the 33d year of the Chacra.

Example according to the Tellinga ac-

As Sevajee reigned in the Peninsula of India, the proposed Chacra year was no doubt computed according to the Tellinga account; and to expound it we are to refer to the appropriate rule, disclosed in the third Memoir, and adverted to at page 148 of this work; the process of which is still more simple than the former.

Now as we know that Sevajee died in the 4782d year of the Cali yug (4781 complete), answering to A. D. 1680, find the Chacra year corresponding thereto.

<sup>(\*)</sup> Vide Postscript to the 3d Memoir, page 213,

But Vicari is the 33d of the Chacra, and as the Epoch which we have expounded is that of Sevajee's death, it is manifest that the year sought is that which preceded Raudra, the 54th; hence 54 - 33 = 21 years to be subtracted from 4782; we have therefore A. Cal. 4761, answering to A. D. 1659, for the Epoch which corresponds to the proposed Vicari, and which needs no further demonstration.

The  $E_{\rm p}$  och being thus recovered, the Ayanansa may be computed, and the process for expounding any particular date of the same, (as shewn in the first part of this article) will apply.

The Averarsa an unitarity data for receiving a lost Hoosis.

Lastly, it sometimes happens (though not in inscriptions, perwanas, nor grants; but in Astronomical documents) that the Ayanansa remains among the Elements which have been preserved, although the numeral of the year has been lost. This case admits of a ready and uncerting solution, by means of Table XXXV, which in all cases will restore the Epoch, as must be well known to the reader.

### SECOND CASE.

The date of an ancient Solar E lipse e pounded into Aindu Solar una,

The most ancient Eclipse which has been transmitted to us by the Babylonians, occurred on the 19th March A. A. Christum 720; at 6' 45' p.m. Meridian of Paris. — Wanted the concurring Hindu Epoch of the same Eclipse under the Meridian of Lanca; together with the error of the Hindu Solar Tables at that time.

#### CAUTION.

A. A. C. 720, 6h 45' p. m. Meridian of Paris.

- 19 The year 720 before Christ is a Bissextile one; therefore for finding its Dominical Letters, we are to use the first part of Table VI.
- 20 And because the proposed year ascends before the birth of Christ, for finding the commencement of the corresponding Solar Sydereal year, we are to use the third part of Table V.

A. Cali yug 2382 current.

- 30 The notation of the year of the Cali yag will be 3102 720 = 2382; and as it preceded the institution of the æras Vicramaditya, and Salivahana, it cannot be expressed in the same.
- 49 By Table V, part 3, as the 2302d and 2402d years of the Califying began on the 7th March, there can be no doubt but that the proposed year commenced very near to the same date in its own month of March.

#### OPERATION.

For the time of beginning of the Hiadu Solar year. For the commencement of the 2382d year of the Cali yug, answering to A. A. C. 720.

Soota dina, Wednesday.

To expound this feria into its European date, we find by Table V. part 3, that the Secular Christian year before Christ 700, began on a Thursday; and by Table VI, part 1st (the year being

2 Bissextile one) that 4 days are to be subtructed from the said Thursday in order to obtain the feria on which that year began, which falls therefore on a Sunday: hence the Dominical Letters sought are AG.

Now, as the date falls in March, with G as the Dominical Letter, refer to the Kalendar about the 7th of that month, and you will find that Wednesday (the Soota dina) falls on the 7th of March.

7th March A. A. C. 720.

But the proposed date is the 19th, therefore adding 12 days to the 1st Vaisacha, we have the 13th of that month current (the 12th complete) for the date of the Eclipse, and to have its precise time at Lanca according to Hindu reckoning, say,

Time from noon at Paris 6 48 0 p. m.
To count the time from Sun rising, add 6
And to refer to the Meridian of Lanca - 4 54 12

Time of Eclipse counted from Sun rise, European hours, &c. 17 42 12

The same converted into Hindu guddias, viguddias, &c. 44 15 15 12 after © rising.

Answer.—The Hindu Solar date of the Eclipse which occurred on Monday the 19th March A. A. C. 720, at 6\* 48' p. m. at Paris, would have been expected at Lanca on Monday the 13th Vaisacha of the 2332d year of the Coli yug, at 41 15' 30° after Sun rise.

Hindu Solar time of Eclipse at Lanca.

Let us now consider what would be the error in the Sun's mean Longitude at that time, according to the Hindu Tables.

For the error of the Hindu Solar Tables.

I. We have seen that the month Vaisacha and year 2382 of the Cali yug began on Wednes-day, at 46° 15' 0', after Sun rise at Lanca, when the Sun's Sydereal Longitude was supposed to be == 0.

Now if we compute the Ayanansa for the beginning of the said year, it will be found = 18° 17′ 6°.

Ayanansa — 18° 17'
6" mem Tropical
Longitude of 1st
point in the Sydereal Zodiac 11s, 11°
42′ 54″ Hindu account,

which day as we have seen, fell on the 7th March A. A. C. 720.

II. The Hindu Solar date of the Eclipse being the 13th Vaisacha (12th complete), the Sun's mean motion must be added to the above Longitude for that number of days.

Time wanting to complete the 12th Sydereal day.

which were wanting of the 12th Sydereal day complete, when the Eclipse was to occur; and during that time the Sun's mean motion was 1' 57", 8 which quantity is therefore to be subtracted. Hence,

Tropical Sun's Longitude at the time of Eclipse according to the Hindu Kalendar 11s. 23° 30' 37°.

according to the Kalendar, but which is inconsistent with the existence of the Eclipse.

III. In order to find the error of the Hinda Tables, let the time for which it was predicted according to the Solar Kalendar, be equated by means of the formula given at page 253, Proposition II.

$$T = \beta + 1 + SnC + A + ma + dx$$
.

Operation.

A. A. C. 720 
$$nC = 24$$
. m 20.  $SnC = 2^{1} \cdot 56^{2} \cdot 1^{3} \cdot 36^{9}$ . m  $a = 1^{2} \cdot 28^{3} \cdot 1^{9}$ . Epoch 1700  $A = 7^{3} \cdot 12^{9}$ .  $SnC = 2^{1} \cdot 56^{2} \cdot 1^{3} \cdot 36^{9}$ . m  $a = 1^{2} \cdot 28^{3} \cdot 1^{9}$ . So  $C = 2^{1} \cdot 56^{2} \cdot 1^{3} \cdot 36^{9}$ . The second secon

Table XXXV, 18° 17' 4' do. XXXVI, 18 17 30

Si.C + 
$$\Lambda$$
 + m 2 =  $\frac{1}{2}$  57 36 49

Difference 26 answering to 10' 35" of time = dx.

Hence

Equated time, Meridian of Paris, T = March 23 6 1 23 p. m.

When the Sun's mean Longitude by Delalande's Tables, or Table LII, will be found to be as follows:

|                                                |       | £. | •  | ,  | •    |
|------------------------------------------------|-------|----|----|----|------|
| O's mean Longitude, 1st January A. A. C. 720   |       | 9  | 2  | 26 | 25,0 |
| O's mean motion for 82 days, Table LII; or 23d | March | 2  | 20 | 49 | 23.1 |
| Do. for 6 hours, 1' 20" do. part 2,            | -     |    |    |    | 10,5 |
| ⊙'s mean Longitude sought                      | -     | 11 | 23 | 30 | 33,6 |

which differs only from that found by means of the Ayanansa, Article II, by 1",6.

IV. Now since the Hindu Kalendar supposed that the Sun's Tropical Longitude on Monday, March the 19th, at 11° 42′ 12″ p. m. at Lanca (1°), was 11° 23° 50′ 38″, whereas it only reached that position on the 23d of the same month at 10° 55′ 35″ (2°), it follows that the Kalendar was 3° 23° 13′ 23″ clow, (3° 58° 3° 27° Hindu time), during

Error of the Hindu Solar Tables in time Sd. 23h. 13' 93", in degrees 5' 52' 35", 4,

which time the Sun would move through 3° 54′ 38′,4, which shows the quantity by which the Hindu Tropical Longitude of the Sun (or the Supplement of the Arc of Ayanansa to 12° at the beginning of the year) was too great; and consequently the Ayanansa too little.

| Hence from the Longitude for<br>Subtract error of Hindu Ta | bles      | icle II, pa | ge 278<br>- | 3 54 38,4          |
|------------------------------------------------------------|-----------|-------------|-------------|--------------------|
| ©'s correct mean Tropical                                  | Longitude | -           | •           | 11 19 35 59,6<br>6 |
| At the time of Eclipse                                     | To verify | y which     | -           | 5 19 35 59,6       |

O's corrected mean Tropical Longitude 5s. 19° 35' 59',6.

"Compute the Sun's apparent Longitude answering to that above found.

|                                               |              | s. | •  | ,  | R    |
|-----------------------------------------------|--------------|----|----|----|------|
| O's mean Longitude                            | -            | 5  | 19 | 35 | 59,6 |
| Equation of the center  Nutation — 2',9       | •            |    | 1  | 42 | 57,6 |
| 21's Equation, 1st part Do. do. 2d part — 2,1 | -            |    |    |    | 3,7  |
| <del> 5,0</del>                               |              |    |    |    |      |
| Q's Equation D's do.                          |              |    |    |    | 1,2  |
| C. Marrie Nettotion and 91 mark               |              |    |    |    | 2,4  |
| Subtract Nutation and 2d part                 | •            | 5  | 21 | 19 | 4,5  |
| 74's Equation                                 | -            |    |    |    | 5,0  |
| ⊙'s apparent Longitude at time of Eclipse     |              | 5  | 21 | 18 | 59,5 |
| The same computed by Dominique Cassini        |              | 5  | 21 | 27 | 0,0  |
| I                                             | Difference . |    |    | 8  | 0,5  |

Sun's apparent Longitude at the time of Eclipse. No apology I conceive, need be offered for this difference of 8' in the Sun's apparent Longitudes at the time of the Eclipse, considering that of the processes through which they have been respectively elicited, and the remoteness of the Epoch.

How to express the San's Sydereal Longitude according to Hindu account. To find the Sun's position in the Hindu Sydereal Ecliptic, and his distance from the Equinoctial point at the time of the Eclipse consistently with the Hindu Solar Tables.

VI. Since according to the Indian computation by means of the Ayanansa, the Sun's mean Longitude on the 13th Vaisácha, at 11<sup>h</sup> 42<sup>l</sup> 12<sup>ll</sup> p. m. (Art. IV), was supposed to be

(Art. II) - . 11 23 30 37

Sun's Madhyama Graha 11' 47' 41", Ravi Sayana 6° 29' 23" uncorrected. His distance to the Vernal Equinox was - - 6 29 23

And as the Ayanansa for the beginning of that year was (Art. II) 18 17 4

His supposed place in the Sydereal Ecliptic should have been = 11 47 41

which will be better understood by referring to the Type.

#### Conclusion.

VII. It follows from this research, that if the Sun's mean Longitude had been rightly expressed in the Hindu Tables (even if no other cause had interfered, such as that of the time occurring during the night) the Eclipse could not have occurred at the predicted time; because that one should have been possible on the 13th of Vaisácha, the Sun's Longitude should have been 11'19' 36' on that day at 44° 15° 30° after Sun rise at Lanca, as we have seen at Article V. But the feria or weekly day on which the European Catalogue states the Eclipse to have occurred, cannot be changed in consequence of any hypothesis in the error of the Hindu Kalendar, and since Monday the 19th March, is that indicated by the former, Monday the 13th Vaisácha (Tamul Chaitram) has been well expounded; from which it follows, that the error lies in the Hindu Solar Tables, and not in the Kalendar.

The error in the Hindu Solar Tables.

If therefore the Sun's Sydereal Longitude be proposed, and the Hindu Solar time be known, and if the Christian corresponding Epoch is to be deduced therefrom (which can only be done by referring the Sun's place in the Sydereal to the European Tropical Ecliptic) the proposed Sydereal Longitude must first be corrected.

Case where the Sun's apparent Longitude is found recorded on an Inscription.

For instance, let it be supposed that the Sun's apparent Longitude in the Sydereal Ecliptic 13° 30′ 41″ was found recorded on an inscription, with the year 2382 of the Cali yug, which reduced to his mean place would be 11° 47′ 41″ (Article VI), if we compute the Ayanansa for the beginning of the said year, it will be — 18° 17′ 4″ (Article III), and if we equate the time of beginning of that year, we shall find the error of the Hindu Tables to be 3° 54′ 33″,4 (Article IV), therefore

The converse of the preceding proposition.

|                                                      |      | - , -               |
|------------------------------------------------------|------|---------------------|
| From the Sun's mean Longitude Subtract error         |      | 11 47 41<br>3 54 38 |
| Corrected Madhyama Graha Which subtract from Ayanana | -    | 7 53 3<br>18 17 4   |
| Ravi Sayana or distance to Equinox                   | . 13 | 10 24 1             |
| Sun's Tropical mean Longitude corrected              | - 11 | 19 35 59            |

And if we convert the same into time by reversing the process for using the Tables, it will be

|                                               | s. | ٥  | •  | *    |
|-----------------------------------------------|----|----|----|------|
| Sun's mean Longitude 1st January A. A. C. 720 | 9  | 2  | 26 | 25   |
| 70 days • •                                   | 2  | 8  | 59 | 43,1 |
| 3 do                                          |    | 7  | 53 | 6,6  |
| 6 hours                                       |    |    | 14 | 47,1 |
| 40 minutes                                    |    |    | 1  | 38,6 |
| 8 do                                          | -  |    |    | 19,4 |
| Time expounded 19th March at 6t 48' p. m.     | 11 | 19 | 36 | 0,1  |

which is the same as was originally proposed, within a trifling fraction of time, the latter Longitude being 1" greater.

# POSTSCRIPT.

I intended to have confined this paper to the preceding pages: but having communicated to a learned friend the following computations of the error of the Hindu Solar Tables, as derived from the Solar Kalendar at the end of each Quadrant of the Ayanansa, when taken in its fictitious form (such as it now obtains among Native Astronomers), he was of opinion that these should not be withheld, because if any modern Jyautish Sastra should ever be qualified to read this work, he would find therein a clear proof of the absurdity of the system to which they are all so generally attached. (\*)

I shall therefore give the calculations of the place of the first point in the Hindu Sydereal Ecliptic, in the Tropical one at the end of each Padah of the Ayanansa, using the formulæ, an account of which was given in the body of this Appendix; and deduce the error of the place assigned to the Sun when in the said points by the Hindu Solar Sydereal Kalendar, in the manner that was adopted in the preceding Examples.

<sup>(\*)</sup> See the Diagram at the top of page 217.

### Case 1.

To find the Tropical Longitude of the first point in the Hindu Sydereal Ecliptic at the end of the first Padah of the Ayanansa, which falls at the expiration of the 1800th year of the Cali yug, answering to A. A. C. 1301.

The formula for this case will be

$$T = \beta + 1 + (SnC + A + m a) + dx \text{ (Prop. II.)}$$

$$\frac{1201}{1700} \quad \text{where } nC = 30. \quad S = 7^2 20^4 4^p. \quad A = 7^4 12^p. \quad m = 1.$$

$$\frac{30}{3001} \quad \frac{1}{ma} = 4^2 24^p.04. \quad SnC + A + ma = 3^4 40^r 13^4 36^p.$$

$$Ayanansa. \quad Tropical Longitude of \gamma.$$

$$\frac{12}{300} \quad \frac{12}{300} \quad \frac$$

And if we expound the time of commencement of the 1801st year of the Cali yug by the rules which were given in the Key to the Madhyama Saura mana, it will be found to fall on March the 3d, at  $28^{\circ}$   $38^{\circ}$   $45^{\circ}$  after Sun rise, under the Meridian of Lanca  $= \beta$ .

#### OPERATION.

$$\beta = \text{March } 3 \text{ 28 } 38 \text{ 45}$$

$$1^{4} + \text{SnC} + A + \text{ma} = - 4 \text{ 40 } 13 \text{ 36}$$
Sum in Hindu guddias, &c.  $8 \text{ 8 } 52 \text{ 21}$ 
do. in European hours, &c.  $8 \text{ 3 } 32 \text{ 56,4}$ 

$$- \text{ II } - 6$$

$$7 \text{ 21 } 32 \text{ 56,4}$$

$$- \text{ II } - 4 \text{ 54 } 12$$

$$7 \text{ 16 } 38 \text{ 44,4}$$

$$+ \text{ dx } + 15 \text{ 12}$$
Time equated, Meridian of Paris,  $T = \text{March } 7 \text{ 16 } 53 \text{ 56,4}$  p. m.

For the Sun's mean Longitude by the European Tables, at the equated instant of time.

For the error of the Hindu Solar Tables.

By the Hindu Kalendar the Sun is supposed to have entered the Sign  $\gamma$  on the 3d March A. A. C. 1301, at 5° 27′ 30″ p. m. (1°), at Lanca; and the Sun's Longitude on the 7th of the same month was 11° 2° 59′ 59″,9 at 21° 48′ 5″ p. m. also at Lanca. The error of the Hindu Tables was therefore 4° 36′ 49″,6 in plus, which is to be subtracted from the Sun's mean Hindu Longitude

March 3 28 38 45 from ⊙ rising

Remainder in Hindu guddias, &c. - 3 13 38 45 p. m.

do. in European hours 3 5 27′ 30′

Paris, March 7 16 53 56 p. m.

+ 4 54 12

Lanca, - 7 21 48 8 p. m.
3 5 27 30

Error in time 4 16 20 38

do. in degrees 4° 36′ 49″,6

in order to have the true one at the time referred to.

by both Tables = 0; therefore dx = 0.

#### CASE 2.

The same for the commencement of the 3601st year of the Colling, answering to A. D. 499, when the Ayanansa completed its second Padah. The formula being the same as in the preceding case.

End of the second Quadrant.

And expounding the time of commencement of the Hindu Solar year as usual, we have

$$\beta = \text{March } 19 \begin{array}{c} 6. & \text{V. P.} \\ 6. & 8 \end{array} \begin{array}{c} 45 \\ 45 \\ 2 \end{array} \begin{array}{c} 28 \end{array} \begin{array}{c} 12 \end{array} \begin{array}{c} 24 \\ 2 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 34 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 25 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 25 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 25 \end{array} \begin{array}{c} 25 \end{array} \begin{array}{c} 21 \end{array} \begin{array}{c} 25 \end{array} \begin{array}{c}$$

For the Sun's mean Longitude by the European Tables.

differing only 0,8 from the Hindu Ayanansa,

For the error of the Hindu Solar Tables.

By the Hindu Kalendar the Sun is supposed to have entered the Sign γ on the 13th March A. D. 499, at 20° 27′ 30″ p. m. at Lanca (1° ), and the Sun's Tropical Longitude was 0° 0° 0′ 0″ on the 21st March at 7° 44′ 27″ p. m. also at Lanca, by the European Tables. The error of the Hindu Tables was therefore 2° 26′ 4″,8 in plus, as in the foregoing case, and is therefore sub-

March 19 6 8 45 from © rising.

— 15

— 18 51 8 45

March 18 20° 27′ 30° p. m.

20 March 21 2 50 15

— 4 51 12

— 21 7 44 27 p. m.

18 20 27 30

Error in Hindu time 2' 11° 16′ 57°

do. in degrees . 2° 26′ 4″,8

tractive of his Hindu Longitude at the time referred to.

#### CASE 3.

End of the third Quadract.

The same for the commencement of the Hindu Solar year 5401 of the Cali yug, answering to A. D. 2299, when the Ayanansa will complete its third Quadrant.

In this case the formula becomes

$$T = g + 1 - (SnC + B + ma) - dx.$$
2299
$$nC = 4. \quad m = 99. \quad ma = 99 \times 4 \times 24 \text{ p}, 01 = 75 \text{ 157 40p}.$$

$$1800$$

$$(4)99$$

$$SnC + B + ma = 435 \text{ 48p}. \quad B = 75 \text{ 12v} 52p.$$

Ayanansa and Longitude.

Table XXXV, 27 0 0
do. XXXVI, 27 0 37,5

Difference 37,5

answering to 15' 15" = dx.

And expounding the commencement of the Solar year as usual, we shall find

$$\beta = \text{April } 3 \quad 43 \quad 38 \quad 45$$

$$+ 1 \text{ day } - 1$$

$$- \text{SnC+B+ma} = - \frac{4}{13} \quad 43 \quad 33 \quad 45$$

$$- \text{SnC+B+ma} = -\frac{4}{13} \quad 43 \quad 43 \quad 43$$
Remainder, Hindu Time - \frac{5}{59} \frac{49}{19} \frac{57}{19}

do. in European hours - \frac{3}{13} \frac{23}{15} \frac{55}{59}, 6
$$- H = 6$$

$$- H = 6$$

$$- L = 4 \quad 54 \quad 12$$

$$- 3 \quad 13 \quad 1 \quad 47$$

$$- dx = -15 \quad 15$$
Equated time at Paris, T = April 3 \quad 12 \quad 46 \quad 32

For the Sun's Longitude in the Tropical Ecliptic by the European Tables.

differing only 0",2 from the Hindu Ayanansa.

For the error of the Hindu Tables.

By the Hindu Kalendar the Sun, it is supposed will enter Mesha γ on the 3d April, A. D. 2299, at 11<sup>h</sup> 27′ 30″ p. m. at Lanca; and the Sun's Longitude on the same day at 17″ 40′ 44″ p. m. was 26° 59′ 59″,8 also at Lanca. The error of the Hindu Tables will therefore be 15′ 19″,7 in plus, and as in the preceding case, is to be subtracted

| 1º April       | G. V. P.<br>3 □ 33 45 from ⊙ rise.<br>— 15 |
|----------------|--------------------------------------------|
|                | 3 28 38 45                                 |
|                | 3 11° 27′ 30″ p. m.                        |
| Paris, April   | n. / " 3 12 46 32 + 4 51 12                |
| Lanca, -       | 3 17 40 44<br>3 11 27 30                   |
| Error in time  | 0 6 13 14                                  |
| do. in degrees | 15' 19",7                                  |

from the Sun's mean Hindu Longitude at the time referred to.

#### CASE 4.

The same for the commencement of the year 1 of the Cali yug, answering to A. A. C 3101, and for that of A. Cal. 7201, answering to A. D. 4099, at both of which Epochs the Ayanansa is supposed by the Hindu Astronomers, to be in the beginning of its first Quadrant.

Reginning of the 1st and end of the 4th Quadrant.

These two cases are to be resolved by means of the formula exhibited at Propositions II and III respectively (page 253), the first being applicable to all years ascending from A. A. C. 1301 in the first Quadrant, and the second to those descending from A. D. 2299 to 4099 in the fourth Quadrant of the Ayanansa. (\*) As both these Epochs are very remote, the reader may not be displeased to find here a last Example of the manner of expounding the beginnings of A. Cal. 1 and 7201.

## First Epoch. I.

For the value of 3 in A. C. 1.

D. By Table VIII, A. A. C. 3000 (3) 58 0 Table 1, for 100 years, subtract (6) 52 5 0 (4)ô 40 0 Do. for 1 year, subtract (1)15 31 15 Initial Root, A. C. 1, sought (2)51 45 Soota dina, Tuesday:

1st Epoch, A. Cal. 1. A. A. C. 5191. to expound which into its European date, we find by the Supplement to Table V, that the Dominical Letter for A. A. C. 3100, is AG, therefore that for 3101 is B; and by the Table itself, that the 102d year of the Cali yug, answering to 3000 years, begins on the 16th February.—But the commencement of the Hindu Solar years anticipate only 9 days in 1000 ascending years (vide Tables), therefore referring to any perpetual Kalendar with the Dominical Letter B, about the 16th of February, we find Tuesday the Soota dina, to fall on the 15th February. Hence the value of  $\beta$  in the formula is, February 15th, 51° 8° 45°. (\*)

II.

Expounding now the formula 
$$T = \beta + 1 \text{day} + (\text{SnC} + A + m \, a) + dx$$
, as usual, we have

3101  $nC = 48$ .  $m = 1$ .  $m \, a = 4^{\circ} \, 24^{\circ}$ ,01.  $\text{SnC} + A + m \, a = 5^{\circ} \, 52^{\circ} \, 14^{\circ} \, 48^{\circ}$ .

1700  $A = 7^{\circ} \, 12^{\circ}$ .

(43) C1  $\beta = \text{February} \, 15 \, 51 \, 8 \, 45 \, \text{from} \, \odot \, \text{rise}$ .

Avanansa.  $+1 \, \text{day} + \, \text{SnC} + A + m \, a = 6 \, 52 \, 14 \, 48$ 

Table XXXV,  $1^{\circ} \, 24^{\circ} \, 0' \, 0'$ 

do. XXXVI,  $1 \, 24 \, 1 \, 14$ 

Difference  $1 \, 14$ 

Buropean time  $-22 \, 17^{\circ} \, 21' \, 25'', 2$ 

answering to 30' 20'' of time  $= dx$ .

Longitude  $10 \, 6$ 
 $-1 \, 24 \, 0$ 
 $-1 \, 22 \, 11 \, 21 \, 25, 2 \, p$ . m.

 $-1 \, 4 \, 54 \, 12$ 
 $-1 \, 4 \, 54 \, 12$ 

Equated time, Meridian of Paris,  $T = \text{February} \, 22 \, 6 \, 57 \, 33$ 

For the Sun's mean Longitude according to the European Tables.

|                  |               |            |           |        |      | S.       | •  | •  | A    |
|------------------|---------------|------------|-----------|--------|------|----------|----|----|------|
| Table LII, O's m | ean Longitude | 31st Decen | ber A. A. | C. 31  | 02 - | 8        | 13 | 28 | 30,6 |
| O's mean motion  |               |            |           | _      | -    |          |    |    | 21.5 |
| Do.              | 6 hours       | -          | -         |        | -    |          |    | 14 | 47,1 |
|                  | 57 minutes    | _          | -         | -      | -    |          |    | 2  | 20,4 |
|                  | 33 seconds    | •          | •         | -      | -    |          |    |    | 1,3  |
|                  | ⊘'s mean      | Longitude  | at Equate | d time | -    | 10<br>12 | 6  | 0  | 0,9  |
|                  | European      | Ayanansa   | •         | -      |      | 1        | 23 | 59 | 59,1 |

differing only from the Hindu Ayanansa by 0",9.

III.

Now this Supplement of the Sun's Longitude amounting to 1' 23' 59' 59", 1, or say 1' 24', one

<sup>(\*)</sup> The Cali yag is valgarly supposed to begin on a Friday, but it is to be remembered that, in order to make its commencement fall with the beginning of the week, as it was than reckoned, a Cshepa of 2d. Eg. 51v. 15p. was added to the Ahargana. (Vide Key to the Madkyama Saura Mana, page 10.)

half of which is 27°, shews that whereas the Tabular Ayanansa goes on increasing (and its Supplement decreasing) from A. A. C. 1301 to 3101, the Epicircular one has a contrary progress; so that whatever view ancient Astronomers may have taken of that Element at the time referred to, it is certain that their modern successors would equate it into  $+27^{\circ}-27^{\circ} = 0$ .

In order to deduce the error in the Sun's mean position which would result from such a theory, we are not therefore to confine ourselves to a comparison of "what the Sun's Longitude is sup"posed to be and really is at the given instant at Lanca," as we have done hitherto; but we are also to account for 54° of Ayananse, rejected by the absurd system of Libration, which answer to 54° 18° 52′ 22° of time.

IV.

For the error of the Tables.

Now by the preceding operation it appears that by the Hindu Kalendar, the Sun entered Mesha γ on the 15th February at 14° 27′ 30° p. m. at Lanca (1°, ), in A. A. C. 3101; and that the Sun's Tropical Longitude according to the European Tables was 10° 6° on the 22d February at 11° 51′ 45″ p. m. also at Lanca (2°), the first part of the error of the Hindu Tables is therefore 6° 47′ 34″,6, and the second 1° 24°, amounting in all to 2° 0° 47′ 34″,6 in plus, 25 before,

(10)Ħ. February 15 51 8 45 from O rise. \_\_ 15 Hindu time 15 36 February 15 14 27 30 p. m. (20) н. February 22 6 57 33 p. m. February 22 11 51 45 15 14 27 30 Error in time 6 21 24 15 p. m. do. in degrees 6° 47′ 34″,6 1,51 Total error = 2 0 47 34.6

by which the Hindu Astronomers of ancient times, (or rather some more recent speculator deceived at the time of observation by the effects of the Solar Equation and the nutation of the Earth's Axis, which he could not otherwise explain) would have mistaken the Sun's position relatively to the Equinoxes, at the commencement of the Cali yug; a supposition wholly untenable.

SECOND EPOCH.

I.

The same resolution for the beginning of the 7201st year of the Cali yug, answering to A. D. 2d Epoch, A. C. 7201, A. D. 4099.

The formula in this case is  $T = \beta + 1 - (\operatorname{SnC} + B + \operatorname{ma}) - dx$ .

Proceeding as usual for the value of  $\beta$  by means of Tables I and VII, we **n. c. v. p.** shall find the initial root for A. C. 7201, answering to A. D. 4099, to be (0) 21 8 45 and the Soota dina - Sunday.;

to expound which the Dominical Letter may be found as follows:

II.

The series in Table V, part 1, extends only to A. D. 2000; but that which we want, as it refers to the Julian Kalendar, may easily be deduced from that Table, by extending it to the given year: a process which hardly requires two minutes of time. In this manner the Dominical Letters for A. D. 4100 will be found to be CB, and that for the preceding year, now wanted, D.

For expounding the Soota dina, Sunday, into its European date, we find (arguing as we did in the preceding article) that in 2000 years descending, the beginning of the Hindu Solar year retards 17 days in the European corresponding Julian year. But in A. D. 2000 it begun on the 31st March; adding therefore 17 days thereto for the year concurring with A. D. 4000, and then adding again a day (nearly) for each century, we are sure to find the beginning of the 7201st of the Cali yug (A. D. 4099) about the 18th April.

Referring therefore to the Kalendar with the Dominical Letter D, we find that Sunday, the Scota dina, will fall on the 19th April A. D. 4092.

The value of & will accordingly be, April 19th, 21' 8' 45".

III.

To expound the formula we have, therefore,

do. XXXVI, 1 21 D'fference

answering as before to 30' 20" of time =dx.

For the Sun's mean Longitude by the European Tables at the Equated time.

IV.

By Table LII, Sun's mean Longitude 31st December 4098, - 10 8 35 17.9 Sun's mean motion for 106 days, or 16th April 3 14 28 43,0 22 hours 54 12,6 42 minutes 1 43,5 58 seconds 2,4

Sun's mean Longitude at Equated time 1 23 59 59,4 differing only by 0°,6 from the Hindu Ayanansa.

#### For the error of the Hindu Tables.

By the Hindu Kalendar the Sun is supposed to enter Mesha γ on the 19th April at 2<sup>h</sup> 27′ 30″ p.m. A. D. 4099, at Lanca, and the Sun's Tropical Longitude was found 1° 24° according to the European Tables on the 17th April at 3<sup>h</sup> 37′ 10″ p. m. also at Lanca.

| 10       | <b>A</b> pril      | 19<br>— |     | v.<br>8  |      | from   | 0  | rising |
|----------|--------------------|---------|-----|----------|------|--------|----|--------|
|          |                    | 19      | 6   | 8        | 45   |        |    |        |
|          | April              | 19      | 2   | 27       | 30   | ' p. τ | n. |        |
| 20       | <b>A</b> pril      |         |     |          |      |        | u. |        |
|          | April              |         |     | 37<br>27 |      |        |    |        |
| Error in | time -             | 1       | 22  | 50       | 20   | •      |    |        |
|          | egrees<br>Ayanansa |         |     |          |      |        |    |        |
| Total er | ror - 1            | 2       | 5 5 | 5 9      | 24,9 | )      |    |        |

Now as the Ayanansa goes on increasing in the Tables with a contrary Sign from that which it had at the preceding Epoch, whereas according to the Libratory doctrine it decreases from A. D. 2299 descending until in A. D. 4099, when it becomes equal to zero, making the Ayanansa 54° equal to  $+27^{\circ}-27^{\circ}=0$ , it follows that the error of the Tables deduced from this operation amounts to 1° 55′ 24″,9 in its first part in minus, and consequently is to be added to the mean Hindu Longitude; and in the second to 1° 24° also in minus, therefore the whole error is 1° 25° 55′ 24″,9, which was to be determined.

END OF APPENDIX II.



## APPENDIX III.

TRACT ON CHRONOLOGY.

With directions for referring dates recorded in any of the three principal HINDU STYLES, to corresponding ones of any aras registered in the annexed Chronological Table: with an account of the ancient and modern Jewish years.

| · |  |  |   |
|---|--|--|---|
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  |   |
|   |  |  | , |

### APPENDIX III.

A Sketch of some of the principal Æras and Periods of ancient times, referred to in. Chronology; with directions for finding the corresponding years in each of them, to any year proposed according to the Hindu styles of the Cali yug, Vicramaditya, and Salivahana.

In publishing this short tract, which merely consists of extracts from books on Chronology, I am far from imagining that I present any thing new to the attention of the learned reader: but the experience of thirty years in India has taught me, that let works on such topics be ever so common in Europe, they are seldem, and in many cases, no where to be found when wanted in this part of the world.

If any thing could excuse an Indian author for having failed in point of accurate reference, or presented under the garb of novelty, a piece of information which may perhaps be found in every library in England, it would certainly be the penury of books on the sciences here complained of. Indeed it has come to my personal knowledge in another path of research (independently of the origin of the third Memoir of this collection), that the greatest Geometer that came to India since the days of Mr. Robins, (\*) was frequently reduced, in order not to interrupt a work which will transmit his name to posterity, to analyze Problems, and construct Tables, which had been resolved and constructed more than a century before his time.

To return to our subject, I thought that my task would remain incomplete if, after having explored the principal Hindu doctrines which relate to time, I were not to furnish some means for referring them to accounts probably equally ancient, and certainly much better known to the generality of readers. I trust, therefore, that the present endeavour to collect in a small compass a few of the leading features of ancient Chronology, will not be deemed (at least by my Indian readers) a useless increase of this volume.

#### EXTRACTS, &c.

The words Æra and Epoch generally mean the same thing in Chronology. Sometimes however, Epoch is specially used to designate the particular time of an event, without reference to any Æra: we find it also employed in the sense of the beginning of an Æra.

<sup>(\*)</sup> The late Lieut, Colonel William Lambton, Superintendent of the Grand Trigonometrical Survey of India, to whom the author was, during several years, an assistant. It is also related of the late Mr. Andrew Scott, that whilst in the Northern Circars, and wanting a Table of Logarithms, he found no shorter way to procure one, than to construct it himself.

In order to reduce the various accounts of time which have been used by mankind to a common scale, a period of years was invented which, commencing before all known Epochs, involves them all. Such is the *Julian* period, invented by Joseph Julius Scaliger about the middle of the XVIth century.

The Julian period.

Of the Julian period.—This period is a series of 7980 years, arising from the multiplication of the Cycles of the Sun. Moon and Indiction; or of the numbers 23, 19, 15; its Epoch commencing on the 1st day of January of the 706th year before the Creation. The Julian period therefore, is not yet completed.

As every year of that period has its particular Solar, Lunar, and Indiction Cycles; and as no two years in it can have all these three Cycles the same, any year that can be proposed is accurately distinguished from all the rest.

We shall postpone the application of this and following observations to our purposes, until after an account of the most useful Æras has been laid before the reader.

Solar Cycle.

2. The Solar Cycle.—A period of 28 years, beginning with 1 and ending with 28.

Metonic or Lunar Cycle.

3. The Metonic or Lunar Cycle.—A period of 19 years. It only holds true for 310 7 years, because on every 19th year the Moon returns near an hour and a half sooner, which error in 310 7 years, amounts to an entire day.

Indiction.

4. Cycle of Indiction.—A period of 15 years revolving like others, and commencing (by anticipation) 3 years before A. D. 0 complete; or 1 current of the Dyonisian account: So that if 3 be added to any proposed year of Christ, and the sum be divided by 15, the remainder (neglecting the quotient) marks the year of Indiction. The first Indiction was settled and agreed upon in A. D. 313.

Mundane Era,

5. The Mundane Æra, or Epoch of the Creation of the World.—The best authors of Port Royal, in whose number was the celebrated Pascal, and Le Maitre de Saci, place that event 4004 years before the vulgar or Dyonisian Æra. The Jews however, made it 243 years later, or A. A. C. 3761, which is still the Epoch of their Mundane Æra. (\*)

Cali yug.

6. The Cali yug of the Indians.—A period of 432000 years, of which 3101 had expired on the 14th March A. D. 1 current. It is taken to have begun on Friday, the 18th February.

Ein of Nabonassaar.

7. Æra of Nabonassaar, first King of the Chaldeans or Babylonians.—Its Epoch is taken to fall on Wednesday, 26th February A. A. C. 747. Its year was of 365 days, without any intercalation on the 4th.

Olympiads,

8. Olympiads.—A period of 4 years, the first of which began (it is supposed) with the nearest New Moon to the Summer Solstice A. A. C. 776, being the 3938th year of the Julian period, and 24 years before the foundation of Rome. The best Chronologists have computed that, the 1st year of the 195th Olympiad coincided with the 1st year of Incarnation, consequently

<sup>(\*)</sup> Vide Note at the end of this Appendix.

the 5th year of Christ answers to the 1st of the 196th Olympiad. The Olympiadic years began with the Summer Solstice, or rather on the 1st July, so that the six first months of any year of Incarnation answer to one year of the Olympiad, and the six last to another.—The last of these periods was the 404th; and corresponded to A. D. 440.

9. Indian Vicrumaditya.—An Indian Prince who is supposed to have ascended the throne 57 years before Christ. In the northern parts of India, instead of numbering their Luni-solar years from the beginning of the Cali yug, the Natives count them from the accession of Vicramaditya. This denomination however, makes no difference in the construction of the Luni-solar year.

Indian Æra of Vi-

10. Cezarian of Antioch.—An Epoch established by the inhabitants of that town, in commemoration of Cezar's victory at Pharsalia, A. A. C. 47. The Syrians made it begin in the month of August, or on the 9th Sextilis of that year (as it was then called), in which the Greeks differed: the latter fixing it on their month Gorpicus of the preceding year 705 of Rome, or A. A. C. 48, being the Epoch most generally used.

Cezarian of Anti-

11. Iberian or Spanish.—This Æra, which is grounded on the Julian Kalendar, owes its rize to the conquest of Spain, which was achieved by Augustus in the year 715 of Rome, but its fictitious Epoch dates from the 39th year before Christ, beginning with the 1st January of the usuing year. This Æra was long used in Spain, Africa, and the Southern Provinces of France, and was finally abolished in A. D. 1415.

Iberian or Spanish.

12. Indian period Grahaparivrithi, of 90 Solar years, used in the Southern Provinces of the Peninsula of India.—It is stated to be constructed of the sum of the products in days of 15 revolutions of Mars, 22 of Mercury, 11 of Jupiter, 5 of Venus, 29 of Saturn, and 1 of the Sun. Its Epoch is A. A. C. 24. Its years vary by a few hours.

Indian Grahapari-

13. Of Constantinople.—In that period the first year of Incarnation falls in 5509, and answers to the last year of the 195th Olympiad.—This account subsisted as long as the Greek Empire, and the Russians preserved it until the reign of Peter the great. The years of this Æra are either Civil or Ecclesiastical, the first begins with the 1st September; the second sometimes on the 21st March, and at others on the first April.

Æra of Constanti-

14. Of Alexandria.—The first year of the Incarnation answers to the 5503d of that period. It was followed by several of the General Councils, and used in some of the most ancient computations. Like the preceding account, it is supposed to refer to the Creation of the World, but assigning a different Epoch to that event from other accounts.

Of Alexandria.

The Mundane Æra, called that of the Greeks, is the same as that of Alexandria.

Ecclesiastical of Antioch.

15. Ecclesiastical of Antioch.—The 1st year of the Incarnation was taken to correspond to the 5493d of that period; retarding the Epoch of the Creation by 10 years more than the Alexandrian account.

Indian Vrihaspati Chacra, 16. The Indian Vrihaspati Chacra, or Cycle of 60 of Jupiter's years.—This Cycle is constructed on the hypothesis that a revolution of the Planet Jupiter, is equal to 12 of its own years, and consequently 5 revolutions to 60 Vrihaspati years.—These kind of years (if they ever were) are no longer used as an immediate measure of time; but as each of these bears a specific name, they serve for giving a particular designation to every Solar and Luni-solar year during its scope of 60 years, after which the series begins anew in the same order. In the Northern Provinces of India, when Astronomers compute the succession of these years, they refer still to the revolutions of the Planet; in consequence of which, one year is expunged every 86th Solar year.—But the Tellinga Astronomers make no difference between the Vrihaspati, and Solar years, and consequently expunge nothing; so that their years correspond to a different point of the Cycle, or Chacra, and bear a different name.

The year current of the Chacra on the first year of the Christian Æra, was Sadharana, the 44th of the 53d Cycle (vide Postscript to the third Memoir.)

of the Seleucida.

17. Of the Seleucidæ, of which there are two.—These periods are also called of the Syro-Mucedonians, because they originated with the successors of Alexander the great.

The first.

The first Æra of the Seleucidæ takes its rise from the death of Alexander, i. e. A. A. C. 223. It was little used.

The second.

The second has its Epoch 12 years later, and therefore dates 311 before Christ. It answers to the year of Rome 442, and its years are Julian. This Æra has been much in use among the nations of the Levant, and is still followed by the Catholics of Syria. The Jews, after their subjection to the Kings of Syria, adopted it, giving it the name of Tarik-Dilcarnaim (the Æra of Bargains), because they used it in their commercial transactions.

The Æra of the Seleucidæ, is still in use among the Arabs. Alfragan made its year begin on the 1st September, but Albategni on the 1st October.

Indian Æra of Sa-

13. Indian Æra of Salivahana.—The name of a Prince supposed to be born 78 years after Christ, and a descendant of Vicramaditya, of which some account is given at article 9.—This Æra serves to number the Solar years by a shorter account than from the Cali yug; in the same manner as the Æra Vicramaditya is used for the Luni-solar years. The Solar years expressed from the birth of Salivahana are called Saca.

Its years called Saca.

Era of the Martyrs.

19. Of Dioclesian or the Martyrs.—This Æra owes its rise to the elevation of that Emperor to the throne. It is called of the Martyrs, on account of his persecution of the Christians. Its Epoch is A. D. 234, and its year begins on the 29th of August. The Æra of Dioclesian is still used by the Copths and Ethiopians.

Of the Hejira:

20. Of the Hejira.—An Æra followed by the Mahommedans all over the world: its years are Lunar, and of 354 and 355 days, as they are common or intercolaries. It has a Cycle of 30 years,

ever enof which a always of 355 days. Its Epoch is the 16th July 622, but according to most Arabian Astronomers the 15th of the same month.

Share Dgelul-ul-deen, Sultaun of Korassaan.

The two Persian.

The Yerdezirdic.

The Yezdegirdic.—The Epoch of this Æra refers to the accession of that Prince, which took place on the 16th June A. D. 632; ten years after that of the Hejira. The years of this Æra were vague and of 365 days, and the months of 30; but at the end of the month Aben it was customary to add 5 days; which intercalations the Astronomers only introduced at the end of the year. This style was followed in Persia until it was reformed, and superseded by,

The Dgelalcan.

The Dgclalean.-Maleck Shaw Dgelal-ul-deen reformed the Yezdegirdic Kalendar in the year of Christ 1079. Having assembled a council of eight Astronomers for that purpose, they determined that the Vernal Equinox should be fixed on the 14th of March. They maintained the 5 intercalary days or Epagomenes which the Yezdezirdic had borrowed from the Egyptian year. but during 6 or 7 periods of four years (\*) they found it necessary to introduce a sixth Epagomen, as an incidental Equation, after which periods the intercalation of the 5th day would only take place every five years.

The Persian Tropical year consists of 365' 4' 49' 15" 0" 48", which period brings back the Equinoxes and the Solstices on the same days of the year, better than the Gregorian revolutions.

The Dgelalean, or Mutalean style (as it is sometimes called) is still in use in Persia. Although it be not noticed in the Table of Epochs inserted in this article, it may be useful to find here the names of the Persian months and days.

The Months.

| 1 | Asrudia, or<br>Aphrudia, meh,   | 5 | Merded, or<br>Mordad-meh, | 9  | Adar-meh,<br>Di-meh. |
|---|---------------------------------|---|---------------------------|----|----------------------|
| 2 | Ardihasht, or<br>Ardisasht-meh, | 6 | Shirbirrir-meh,           | 11 | Behen-meh,           |
| 3 | Cardi-meh,<br>Thir-meh,         | 8 | Aben-meh,                 | 12 | Assirer-meh.         |

The 5 Epagomenes in the common, and the 6, in the redundant years, are called Musteraca.

The Persians do not divide the month into weeks, like other nations, but they give to each day a specific name.

Names of the days.

|    |               | - m                  |                           |
|----|---------------|----------------------|---------------------------|
| 11 | Hormozd,      | [13] Tir,            | 25  Erd,                  |
| 2  | Behman,       | 14 Dghioush,         | 26, Ashtad,               |
| 3  |               | 15 Dibameher,        | 27 Osman,                 |
| 4  | Sharivar,     | 16 Meher,            | 128 Ramiad,               |
| 5  | Esphendarmod, | 17 Souroush,         | 29 Marasfend,             |
| 6  | Khordad,      | [18] Resh, or Roush, | 30 Aniran.                |
| 7  | Mordad,       | 19 Fevardin,         | Musteraca, or Epagomenes. |
| 8¦ | Dibadur,      | 20 Beheram,          | 1 Ahnoud,                 |
| 9  | Azur,         | 21 Ram,              | 2 Ashnoud,                |
| 10 | Aben,         | [22] Bod,            | 3 Esphendarmer,           |
| 11 | Khour,        | 23 Dibadin,          | 4 Vahest,                 |
| 12 | Mah,          | 24 Din,              | 1 5 Heshounesh.           |
|    |               |                      |                           |

<sup>(\*)</sup> I can find in no book which of the two numbers was used,

Era of Parasurama.

22. Æra of Parasurama.—An account of time used in that part of the Peninsula of India called Malayala by the natives; extending from Mangalore, through the Provinces of Malabar, Cotiote, and Travancore, to Cape Comorin. It derives its name from a Prince who is supposed to have lived in the year 1176 before Christ, and who was a great encourager of Astronomy.

Dr. Buchanan states that the inhabitants of Malayala reckon time in Cycles of 1000 years from that Epoch; and that their year begins when the Sun enters the Sign Canya my (Virgo): answering to the Hindu Solar month Aswina (Tamul Paratasi); and furthermore, that in September A. D. 1800 there were two Cycles and 976 years expired of that Æra, the year commencing, being the 977th of the 3d Cycle.

As the Christian year 1800 answers to the 4902d of the Cali yug, and 1722 from the birth of Salivahana current; and as by these accounts, which represent the same year, the new year began on Thursday the 10th of April (see General Table I), it follows that the Sun will have entered Canya m on Sunday the 14th of September ensuing. (Page 14, and Table III).

The concurrence is therefore as follows:

The commencement of the 977th year of the 3d Cycle of Parasurama, answers to the 1st Aswina (Tamul Paratasi) of the 4902d year of the Cali yug or 1723 Saca; and to the 14th September A. D. 1800.

From what has been stated it also results, that the number of years of the Æra of Parasuaruma expired on the birth of Christ, are 1176, and that the 1177th began on the 1st of Aswina A. Cm. 3102, answering to the 17th of August A. D. 1, Julian style. (Tables V, 2d part, and VII).

And lastly, that the Epoch fell on the 7th August of the year 3537 of the Julian period, answering to the 1926th of the Cali yeg.

Eca of the ancient Jowe.

23. The ancient Jewish Æra.—Although the two Æras of the Jews, and the Luni-solar year of the Ancients (as given by Montucla in his History of the Mathematics, without mentioning the name of the nation which used it) are not included in the Table here annexed, yet as there are many Jewish tribes under the Bombay Presidency, who may be supposed to reckon time according to either, and as both are very little known to Europeans in this part of India, I conceive that some mention of these styles is not foreign to the object of this paper.

Of the ancient Æra I have not been able to collect any very distinct account; I understand that it is never referred to by Chronologists, but for times before Christ; what follows will therefore be sufficient for the present purpose.

That Æra was composed of Lunar years, reckoned from the Creation, which the ancient, as well as modern, Jews place 3761 years before the birth of Christ. The year was of 12

Lunar months, but originally fitted to the Solar one, by adding 11 and sometimes 12 days at the end of the year; but when it assumed a more regular shape, it became embolismic, and subject to a 13th Lunar month. The series of these intercalations, however, I find expressed no where; but is probably the same as that of the modern Jews. In intercalary years, the month Adar was repeated, being of 29 days in common, called defective; and of 30 in embolismic, called redundant.

Again in the defective, Cisleu was only of 29 days, and in the redundant Marshervam, was of 30.

The names of the ancient months were the same as the modern ones, the only difference being that the old Jewish style begins the year with Nisan, and ends it with Adar; whereas the modern begins it with Thisri, and ends it with Elul. The ancient Jews made much use of the Era of Nabonassaar, of which some account has been already given; and their Luni-solar year is still the Ecclesiastical one in present times; at least as far as regards the season when it begins and ends.

A distinction to be made between the Indian, and Jewish years of both styles is, that the embolismic months of the former may fall on any of the five long Solar months of the year, whereas those of the latter invariably fall on the month of Adar.

21. Of the Mundane Æra of the Jews, also called the modern.—This Æra is likewise composed of Lunar years of 12 and 13 months, the intercalations falling on the 3d, 6th, 8th, 11th, 14th, 17th and 19th of the Metonian Cycle. The modern Jews pretend that its institution dates from high antiquity, but most Chronologists affirm that it was unknown before the XIVth century, although some say that it is to be traced up to the XIth. In this account of time, the whole expired duration of the Æra is divided into Cycles of 19 years, and of these 198 had elapsed on the birth of Christ; the last of which ended in the autumn of the first Christian year.

The Lunar months of the Mundane Æ:a, which bear the same names as those of the ancient one, are alternately of 30 and 29 days: they are reckoned like those of the Hejira, to begin on the first appearance of the Moon after the conjunction.

We have already observed that the modern year begins with the month Thisri, instead of that of Nisan, i. e. 6 months later. In embolismic years the month Adar is likewise repeated, but the name of the second Adar is changed into that of Ve Adar, and in the order of the Kalendar, is the 7th of the year; so that Nisan becomes the 8th, Jiar, or Islar, the 9th, and so forth to Elul, which (in the supposed case) is the 13th.

The Civil year of the Jews begins with the new Moon of September, and the Ecclesiastical with that of March; the former following the new, the latter the old Kalendar.

Independently of the modern year being distinguished between common and embolismic, each of these distinctions is also subdivided into three sorts, viz. the deficient, the mean, and the redundant, or superabundant.

Mundane Æra of the Jews, also called the modern,

Civil year of the Jews.

Both common and embolismic years, distinguished into deficient, mean, and redundant. Discarded or unlawful days of the Jews. In order to understand how the Jews determine practically these different species of years, it is necessary to know that they have certain discarded days, on which it is not permitted to celebrate the great festivals of the year, such as Easter-day, the Tabernacles, and Pentecost, or Whit-sunday; for when these happen to fall in the common course of time, on any of the unlawful days, they are respectively transferred to the next lawful one. These contingencies are ruled by the following two precepts, expressed in a few Latin words.

- 10 Nunquam Nisan in Badu.
- 2º Nunquam Thisri in Adu.

Badu expressing the numbers, 2, 4 and 6, and Adu 1, 4 and 6, the prohibited feriæ or weekly days.

Should therefore the new Moon of Nisan fall on the 2d, 4th or 6th feria, its observance is forbidden on those days, lest Easter-day, which is always kept on the 15th of that Moon, should fall on an unlawful day; those on which the Ecclesiastical year is permitted to begin, being called Kebies.

The Kebies or lawful days.

Rosh Ashana, the name of the beginning of the Jewish year. From the same conception of unlawful days, the rule directs that there should be no observance of the new Moon of Thisri, which marks the beginning of the Civil year (called Rosh Ashana) when it falls on the 1st, 4th or 6th feria of the week; for in such a case the festival of the Tabernacles cannot be celebrated as usual, and as Whit-sunday, or Pentecost, is the 50th day after Easter, and must consequently fall on the feria next to that of Easter, the holy day alluded to is not to be kept on either the 3d, 5th or 7th day of the week.

How to find which is a deficient, mean or redundant year. When the lawful day or Kebie on which the year is to begin, has been determined, the Jews find whether it be a common, or an intercalary year, and at the same time (whichever of these it may prove) whether it be a deficient, mean, or redundant one, of its sort, in the following manner.

#### PRECEPT 1.

Precept for a com-

"Subtract the Kebie of the proposed year from that of the following one, and if the latter be less than, or equal to the former, add 7 days thereto: and if the remainder be 3, 4 or 5, the current year is a common one. Furthermore, it is deficient, mean, or redundant, as these numbers are increasing from 3 to 5.

#### PRECEPT 2.

Precept for an em-

- "But if the remainder be 5, 6 or 7, then the proposed year is embolismic. Moreover, it is deficient, mean, or superabundant, as these numbers are increasing from 5 to 7."
  - N. B .- The three sorts of years of each kind, consist of the following number of days.
  - Of the common,—the deficient is 3534; the mean 3514; the redundant 355 days.

Duration of each.

Of the embolismic,—the deficient is 3831; the mean 3841; the redundant 385 days.

#### EXAMPLE 1.

Examples.

Let the Kebic of any proposed year be 3, and that of the following one 7; if we subtract the

former from the latter, the remainder will be 4: which, according to the preceding rule, shews that the given year is a common one; and of that sort, a mean year.

Examples,

#### EXAMPLE 2.

But if the Kebie of the proposed year be 5, and that of the ensuing one also 5; then 5+7=12; and 12 - 5 = 7, which shows that the current year is embolismic, and also a redundant year. Q. E. 1.

Table exhibiting the names of the Jessish months, and the duration of each sort of years and months, whether deficient, mean, or redundant.

| Ī  | Common Jewis               | h year     | s.         |            | !                   |                    | ]    | Embolis                 | mic y      | ears. |            |
|----|----------------------------|------------|------------|------------|---------------------|--------------------|------|-------------------------|------------|-------|------------|
| -  |                            |            | Years      |            | !                   |                    |      |                         |            | Years |            |
|    | Names of<br>Jewish months. | Deficient. | Mean.      | Redundant. | Corresp<br>Julian 1 | oonding<br>nouths. |      | Names of Jewish mouths. | Deficient. | Mean. | Redundant. |
|    | A 1 11                     | Days.      |            | Days.      | 15.                 | A 71               |      | 137*                    |            | Days. |            |
|    | Nisan, or Abib             | 30         | 30         |            | March               | April              | ,    | Nisan                   | 30         | 30    | 30         |
|    | Jiar, Islar, or Zius       | 29         | 29         |            | April               | May                | :    | Jiar                    | 29         | 29    | 29         |
|    | Sieban, or Sievan          | 30         | 30         |            | May                 | June               |      | Sieban                  | 30         | 30    | 30         |
| 1  | Thamuz                     | 29         | <b>2</b> 9 | l .        | June                | July               |      | Thamuz                  | <b>2</b> 9 | 29    | 29         |
|    | Ab                         | 30         | 30         | 30         | July                | August             |      | Ab                      | 30         | 30    | 30         |
|    | Elul                       | 29         | 29         | 29         | August              | Septem.            |      | Elul                    | 29         | 29    | 29         |
|    | Thisri, or Ehanim          | 30         | 30         | 30         | September           |                    |      | Thisri                  | 30         | 30    | 30         |
| 8  | Marshesvam, or Bul         | 29         | 29         | 30         | October             | Novem.             | S    | Marshesvam              | 29         | 29    | 30         |
| 9  | Cisleu, or Casleu          | 29         | 30         | 30         | November            | Decem.             |      | Cisleu                  | 29         | 30    | 30         |
| 10 | Thebeth                    | 29         | 29         | 29         | December            | January            |      | Thebeth                 | 29         | 29    | 29         |
| 11 | Shebeth, or Saabath        | 30         | 30         | 30         | January             | February           | 11   | Saabath                 | 30         | 30    | 30         |
| 12 | Adar                       | 29         | 29         | 29         | February            | March              | 12   | Adar                    | 30         | 30    | 30         |
|    |                            |            |            | <u> </u>   | March               |                    | 13   | Ve Adar?                | 29         | 29    | 29         |
|    | Sums of days -             | 353        | 354        | 355        |                     |                    |      | (inter.)                |            |       | 1          |
|    | -                          |            |            |            |                     | Sun                | is o | f days -                | 383        | 384   | 385        |

25. Luni-solar year of the Ancients.—Montucla, from whose History of the Mathematics the present article was extracted, has omitted to state in what country, and what people made use of this year, which he calls merely "Of the Ancients". His account of it is as follows:

Luni-solar year of the Ancients.

That year is grounded on a Cycle of 19 years, like that of Meton. Its mean duration is 354° 8° 43′ 38° 11″,988, &c. The Cycle was divided into 12 complete, and 7 incomplete years, which last they intercalated, so that their embolismic months fell on the 3d, 6th, 8th, 11th, 14th, 17th, and 19th of the Cycle, being the same in order as that of the Jews, and invariably followed through the ensuing Cycles, both differing from the method of the Indians, according to which the Epochs of intercalations are variable.

Again, as the Ancients found that 99 Lunar months (of 29d 12d 43d 38d 10d, 99, &c.) contained 2923 days and 12 hours, which in 60 years gave an excess over the Sun's mean motion of 3 days; and 30 in 160 years, they omitted at the end of that period, one of the intercalary months. The Luni-solar year of the Indians has in appearance a similar omission; but it must not be supposed to have the least analogy with the expunged month of the Ancients, 10 Because the Cshaya of the

Indians is not confined to 160 years, but may recur after 141 and 19 years; 20 Because, whereas, the Ancients really retrenched one month, the Indians omitted nothing; the supposed Equation bearing entirely on the artificial duration of the year, the names and succession of their months.

The Chaldean Saros OF Sessos.

26. The Chaldean Saros, or Sossos .- Of this Era I shall only observe that although some Gentlemen have funcied that it might have some affinity with the Cycle of Jupiter of 60 years, yet we hardly know more of it than its name. Halley considered it to be the period of 223 Lunar months, used at the time of, and even before Hypparchus, for computing the return of Solar Eclipses. But Delalande affirms, that it was a mistake which originated with Suidas, and is now entirely abandoned.

Application of the Chronological Table.

By means of this Table any year proposed according to either of the Indian accounts, may be referred to the correspending one of any other Æra therein registered,

For let the proposed year be expressed according to the style of the Æras Cali yug, Vicramaditya, or Salivahana; the same may be reduced to Christian account by adding 3101 to the first, 57 to the second, and by subtracting 78 from the third.

Having thus found the Christian year answering to that proposed in any of the three principal Indian accounts, if you want the concurring one of any other Æra, the Epoch of which ascends to any period before Christ, you have the following Precept.

PRECEPT 1.

"To the year of Christ, found as above " directed, add that given in the Table for "the Ara referred to, and the sum will " give the year sought."

For Epochs which fall after Christ.

#### PRECEPT 2.

0

10 If the Æra in which the year is sought begins before Christ.

CHRONOLOGICAL TABLE. ç Reform of the Kalendar in England 1752 29th March 1752. the birth of Christ, and Epochs of subsequent events referred Gregorian reformation of the Ka-1582 lendar 4th October 1582. Era of Dioclesian or of the Mar-280 tyrs, year begins 29th August. Indian Æra of Salivahana, begins 78 with the Mindu Solar year. Indiction. 3 Epoch of the Indian Cycle of 90 years or Grahaparivrithi, begins with the Hindu 24 Solar year. Iberian or Spanish, its year begins with 38 the Julian year. Cezarian of Antioch, year begins in Au-48 Indian Æra of Vicramaditya, begins with 57 the Hindu Luni-solar year. 2d of the Selencidæ, year begins 1st September, but according to the Arabs 1st 312 Oriobir. 746 Æra of Nabonassaar, began 26th Feb. Bailding of Rome, or Roman Æra. 752 Olympiads, year begins 1st July. 770 Indian Era of Parasurama, begins 7th 1176 jη August 3537 of the Julian period. Concurrence of Chronological Procies Indian Ara of the Cali yug, begins Friday 1301 18th February 1612, Julian period. Epoch of Creation according to 4004 Port Royal writers. Epoch of Creation according to Referred to supposed 4007 Hutton. Julian period. 4713 Ecclesiastical of Antioch. D. O complete. 5492 Era of Alexandria. 5502 Æra of Constantinople, begins Civil 1st September, Ecclesiastical 21st 5508 March. Year of Christ complete, according to

Dyonisius Exiguus.

For Epochs before Curist.

For Upochs after Christ.

"To the proposed Iudian year, add its proper Epoch, the sum gives the Christian year; and to the latter add the Epoch of the Æra sought, the sum gives the corresponding year (in that

# Æra) to the proposed Indian year."

When the Epoch falls before Christ and the year sought after,

20 If the Æra, the year of which is sought, as well as the proposed one, begins after Christ.

When both fall after

"To the proposed Indian year, add its proper Epoch, and from the sum, subtract that of the Era sought, the remainder gives the year in the same, which answers to the proposed one."

Christ.

#### EXAMPLE I.

Let the year 4923 of the Cali yug complete, be proposed.—Wanted the year of the Julian period corresponding thereto?

Examples.

| By Precept we have        | -        | _ |   | 4923          |
|---------------------------|----------|---|---|---------------|
| •                         |          |   |   | <b>—</b> 3101 |
|                           |          |   |   | 1322          |
|                           |          |   |   | + 4713        |
| Year of the Julian period | l sought |   | - | 6535          |
| •                         |          |   |   |               |

Year of the Call yog into that of the Julian period,

#### EXAMPLE II.

Let the year Vicramaditya 1879 be proposed: then 1879 — 57 + 4713 = 6535, the same as in the first Example; whence we conclude that the year of the Julian period 6535 answers to the end of the 4923d year of the Cali yug, and the 1879th of Vicramaditya.

#### EXAMPLE III.

Let the same be proposed for the year 1744 from the birth of Salivahana. Then by Precept, 1744+78+4713=6535 of the Julian period.

Year of Salivahana into the same.

But if instead of the corresponding year of the Julian period, we required that of the Æra of the Martyrs, the Epoch of which is 286 years after the year of Incarnation 0; we shall have by Precept 1744 + 78 — 286 = 1536, the corresponding year of the Æra sought.

The converse of these rules is so evident, that it requires no Examples; all that need be added is, that on the above principles, the years of the Cali yug 4923, of Vicramaditya 1879, and Saca 1744, will be found to answer to years of different Æras, as follows:

| To that of Constantinople |   |   | • |   | - | - | <b>7</b> 33 <b>0</b> |
|---------------------------|---|---|---|---|---|---|----------------------|
| of Alexandria 💄           |   | - |   | - | • | - | 7324                 |
| Ecclesiastical of Antioch |   | - |   | - |   | - | 7314                 |
| of the Julian period      |   |   |   | - | - | - | 6535                 |
| of the World              | _ | - |   | _ | - | - | 5826                 |
| of Nabonassaar            | - | _ | - | - | - | _ | <b>2</b> 568         |
| of the Iberian .          |   | - |   |   | - | - | 1860                 |
| of the Martyrs            | - | - | - | - | - | - | 1536                 |
| &c.                       |   |   |   |   |   |   |                      |
|                           |   |   |   |   |   |   |                      |

The Hindu year referred to different Epochs.

There remains to consider the Indian Æras which are subject to Cycles, such as the Grahaparivrithi of 90 years, and Vrihaspati of 60 years.

Mras subject to Cy-

As the former are merely Solar years, as well as the latter, when amputed according to the Tellinga account, the process for finding the mere abstract concurring years is the same as that above explained. But if we consider these when expressed by a specific name, or by cycles and years, the case no longer applies. Thus if we want merely the year of the Grahaparivrithi which

The Grahaparivrithi, or Cycle of 90 years. expired in A. D. 1822, we need only add 24 thereto, and it will be 1846, so that referring to Examples I and II, the year of the Julian period corresponding thereto will be 6535, as before.

But if the number of cycles and years expired be given, which would be found by  $\frac{1822+24}{90}$ = 20 cycles, 46 years complete, or 21° 47° current, that expression must be decomposed before referring it to any year of another Æra.

The Vrihaspati or Cycle of 60 years.

According to the

Tellingas.

In the same manner the years of the Vrihaspati Chacra, by the Tellinga account, are always presented either by names or numerals; and the Chacra year corresponding to A. D. 1822, would be elicited by 60)4923(82° 3° expired; and the remaining three years counted from Pramathi, (the 3 13th of the Chacra) as zero, would give Chitrabhanu the 16th of the Cycle, for the name of the current year; so that by a circuitous road, that of the Cali yug to which it corresponds might be discovered, and the rest would follow.

According to the Siddhantas.

The same thing may also be said of the year of the Chacra, when referred to the mean heliocentric motion of Jupiter, which seems still more irreducible, than the Tellinga, when proposed only by its name, and number of cycles expired.

The year of Jupiter which answers to any year of the Cali yug, according to the account of the Surriah Siddhanta, may always be found, by a very simple process, the particulars of which were given in a Postscript to the third Memoir of this collection, and which for the same year 4923, will clicit Vijaya the 27th of the cycle.

When the Epoch is known within 60 years, and the specific name of the current Vrihaspati year is given, then the concurring year of the Cali yug may be discovered by means that were indicated in the second Appendix,

#### NOTE.

I have not been able to discover upon what authority Dr. Hutton places the Epoch of the Creation of the world in A. A. C. 4007, as he does in the Chronological Table which he has published in his Mathematical Dictionary, vol. I, page 434. For independently of the Port Royal writers, who have fixed it in A. A. C. 4004, I find the following passage in Voiron's continuation of Bailly's Astronomy.

- "La Place determine deux Epoques Astronomiques tres remarquables; la premiere par la coincidence du grand Axe de l'orbe terrestre avec la ligne des Equinoxes; la seconde par sa
- osition perpendiculaire sur cette ligne, il finit remouter la premiere a l'au 4004 avant Jesus
- Christ, tems ou la pluspart des Chronologistes placent la Creation du monde ; la seconde a l'au
- " 1250 de l'Ere Chretienne." Page 197.

Notwithstanding these testimonies, Dr. Hutton's authority is too respectable to be laid aside, without knowing upon what ground he has decided the question; and on that account I have preserved his Epoch in the Table inserted at page 302.

# APPENDIX IV.

ON THE

HINDU EPHEMERIDES.

| 1 |  |  |   |  |
|---|--|--|---|--|
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
| - |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  | - |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |
|   |  |  |   |  |

### APPENDIX IV.

Giving some account of the Hindu Ephemerides and of the subsidiary articles of the Kalendars.

THE Solar and Luni-solar Kalendars contain each the same articles, but differently arranged; and as the former is computed by the Solar, or Vakiam, process; whereas the latter follows the Sydereal rules of the Surriah Siddhanta, there is a difference in the results which may sometimes amount to six hours of time. As for the rest, the explanation of the contents of one, is perfectly sufficient for understanding those of the other.

Of the Ravi Panchangum.

The Solar Kalendar, independently of the months and civil days, which (like all others) it registers, gives also the time when the most remarkable phænomena occur.

The Solar Kalendar.

The word Panchangum implies five articles, which are permanently inserted in its margin; but besides these, there are several others, which, not being *Ephemeral*, appear of course only when occasion requires it.

The margin of the Solar Kalendar always opens with an accessary article, independent of its year, but intimately connected with the moral habits and superstitions of the Hindus. It registers the name of, and the time when, the Tidhi which is coupled with any Solar day in the year, terminates: It also notices in what Pacsha (the demi-lunar corresponding month) the time is running: and lastly, when a Tidhi is repeated, or expunged out of the Chandra Panchangum.

Its contents.

The permanent articles, as we have stated in article 2 of the Key to the Siddhanta Chandra mana (page 73), are

Five permanent articles.

1º The name of the Nacshatra in which the Moon happens to be on any particular day; with the time of her passing to the next.

The Nacshatra in which the Moen happens to be.

2º The Yogù (an Astrological Element) or the space of time during which the sum of the Sun and Moon's motion, amounts to one Nacshatra, or 13° 20', with the time when that Arc is completed.

The Yogu.

3º The Curna (another Astrological Element) or space of time during which the Moon's motion from the Sun amounts to 6°, there being two Curnas in a Tidhi, and the Kalendar registering the time of its ending.

The Curna;

40 The Thyajum or Thyagum of the Wurjum (another Astrological Element), being the unlucky

The Thyajum of the Wurjum.

period of the day, the mean duration of which is about 4 guddias (1<sup>h</sup> 36' European time), pending which all voluntary business of importance ought to be suspended; marking the time of its beginning.

When the Wurjum occurs at day time, it is called Devi, and when at night Ratree. .

The Isharum or Icharum.

50 The Isharum or Tcharum; being an account of the position of the Planets, (including Rahu & and Ketu %) on any day in the year; and the time when either of them enters any of the four quarters, or Padahs, of a Nacshatra; marking thus the time of their position at every 3° 20′ of the Lunar Zodiac.

Rahu 8 and Ketu 93 considered as Planets. N. B.—Whenever the Planets are mentioned in the following statement, it is always to be understood that the Moon's ascending and descending Nodes are considered to be of the number, according to the Hindu notions, which account for the Eclipses, in a physical sense, by supposing these to be obscure Planets.

Accidental articies.

The accidental articles are partly Astronomical, and partly Astrological, like the permanent ones; and are as follows:

Solar and Lonar Eclipses; the Soa in the Equinoxes or Solstices, and entering a new Sign, 1º The Solar and Lunar Eclipses; the time when the Sun is in the Equinoxes or the Solstices (Mesha Ayana, Tula Ayana, meaning the Equinoxes; Vutra Ayana, Detchana Ayana, the Solstices); and also the time of his entering a new Sign.

The Crantum.

20 The Crantum (an Astrological Element). I have been at some pains to understand distinctly the nature of this article, as well as that of the Vethci, which is connected with, and follows it; and I am not without some doubts whether after all, I have construed either accurately. What follows is therefore, the best that I could make out of the account given to me of both by my instructor.

The literal meaning of Crantum, is overpowered; and that of any Planet, is when it is in conjunction with, or is overpowered by, the Moon; which consequently implies, that the time of new Moon is the Sun's Crantum.

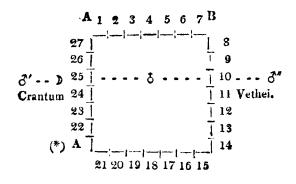
Mars, Saturn, Rahu & and Ketu &, have a bad influence in Crantum, and mark unlucky days. The other Planets have also their Crantums, but being innoxious, they are not noticed in the Panchangum.

The Vethei.

3º The Vethei (also an Astrological Element). The literal meaning of this word is to break, to cleave, or to corrupt. The Vethei is determined by the Planet to which it refers, being in opposition to the Moon in a particular arrangement of the Lunar Zodiac; which certainly does not imply in all cases a real opposition in the Heavens; it is supposed to be the converse of the Crantum, and to partake of its good and bad influences and qualities.

The construction of the Cruntum and Veiles explained,

The Native Astrologers use a Diagram to explain these phænomena, of which here follows at representation.



Let the 27 regular Nacshatras, together with the Abhijit (\*) or extraordinary one, be disposed in a square, each side of which contains seven Nacshatras. Let the Earth stand somewhere in the interior of this square, and conceive the Planets to revolve around it, the Moon being the nearest to the Earth. The magical square so constructed, is called Servatoo Bhadra Chacra.

Now the day on which the Sun or Planet is in a Nacshatra with the Moon on a line with . 3, is the Crantum of the Sun or Planet referred to.

But, (every thing besides remaining as before) if the same Planet, instead of being in &', happens to be in &' in a Nacshatra as far distant from B, as D is of A, then it is in Vethei.

Thus if A represents the Nacshatra Aswini (the 1st), and the Moon be in the third before A, i. e. in Purva Bhadrapada (the 25th), and if the Planet Mars appears from the Earth in the latter Nacshatra on the same day, then it is overpowered, or in Crantum.

But if at the time that the Moon is in three Nacshatras behind A, Mars is in three Nacshatras before B, or which is the same thing in ten before A, (which in the present supposition will be Magha), then S'' is in Vethei, or corrupted.

It needs no great reflection to perceive that such a scheme belongs neither to regular Astronomy, nor Astrology; but savours more of the art of magic than any thing else: for even Astrology, where it is connected with Astronomy, is symmetrical; and uses regular constructions, even though its ultimate object be fantastical.

Here on the contrary, we see the extraordinary Nacshatra Abhijit, which contains only an Arc of 5° (3° 20' of which it borrows from Uttara A'shad'ha the 21st, and 1° 40' from Sravana the 22d, so as to leave the Lunar Zodiac to consist, as before of 360°) reckoned in the magical square as an entire and additional one of 13° 20'. And again, if the Moon happens to be at the top or bottom of the square, and a Planet be in Vethei, so far from the line which passes through the Moon, the Earth and the Planet, dividing the Heavens into two equal parts, (as an opposition implies) it cleaves it in two segments of 21 and 7 Nacshatras each.

In either cases of the Crantum or Vethei, Mars, Saturn, Rahu & and Ketu &, have an evil influence: and therefore, no marriage ceremony, nor any other of rejoicings ought to be performed. But the Srardum, or ceremonies for deceased ancestors, or relatives, may go on as usual.

4. The Latta (also an Astrological Element). This word literally means struck, kicked, The Latta. and like the former, has its application to the concerns of mankind.

There are two sorts of Laltus, viz. the Eastern and the Western; those of the Sun, Mars and Saturn, being accounted East, and of Rahu & and Ketu & West.

The conception of this fanciful Element is as follows:

Manner of computing the same. Whenever the Sun is in 12 Nacshatras (the other Planets have a different scale) counted Eastward from that in which the Moon happens to be, then it is Latta or struck. Mars, and Saturn's Lattas are also East, but they are struck, the former in the 9th, the latter in the 3d Nacshatra from that of which the Moon is in possession. On the contrary, Rahu & and Ketu & because I suppose their motion is retrograde) are kicked in the 8th and 9th Nacshatra from the Moon, on the West. The other Planets not mentioned in the above list, have also their turn of chastisement, but as they bear it patiently, and do not repeat it on mankind, no notice is taken of it in the Panchangum.

When the Latta is accounted East, the Nacshatras are to be counted from the Moon, according to their order in the Lunar Zodiac; and when West, contrary to it. Thus, for example, if we suppose the Moon in the Nacshatra Swáti (the 15th) and if the Sun be in Uttara Bhadrapada (the 26th among the regulars, but the 27th on account of the Abhijit), then it is Latta. But if Rahu & be at the same time in Pushia (the 7th in the Zodiac, and as the Moon is supposed to be in the 15th, the 8th from the Moon), then it is also Latta.

The days on which the Crantum, Vethei, and Latta lad, when referred to the Sun, Mars, Saturn, Rahu and Ketn, are inauspicrous ones, This critical circumstance, which can only occur once in a month for each of the above mentioned Planets, imposes the same restrictions as the Crantum and Vethei.

Such are the principal Astronomical and Astrological articles of the Indian Ephemerides; which I have endeavoured to understand, and explain, in order to shew the cause of those pretences of religious and moral inhibitions, under the screen of which the Natives of all classes postpone business, or neglect their duties, often to the great inconveniency of the public service, but more particularly of that of private individuals. (\*)

Besides the articles above particularized, the Panchangum exhibits a variety of notices which refer principally to religious observances. Such are the birth days, accessions, and anniversaries of memorable events and feats of certain gods, goddesses, spirits, patriarchs and other worthies; including the anniversaries of the beginning of the Calpa, Manwantaras, Mahayugs, and of the four lesser Yugs of the Manwantara in which we live.

Anniversaries generally observed. The anniversaries which are more particularly specified, are those of the ten incarnations of Vishuu; those of the Gowrics (certain female spirits or genii on which the Vritham or solema fast is to be kept) and the accession of the patriarchs, fourteen in number; which are supposed

<sup>(\*)</sup> There is an opinion among a certain set of Brahmins, that in those Luni-solar years where two menths are repeated, and one is expunged, no religious coremony ought to be performed during the first intercalated Lunir month of the said year. This proposition having been argued in the year 1823 (which presented a case in point) in a full Sanhedom of Brahmins and Pundits at Madras, was condemned as heretical; and the Brahmin who supported it was excommunicated.

to preside successively over the fourteen Manwantaras (308448000') which, with the Sandhya or twilight (17280000') constitute the Calpa (4320000000').

It is the opinion of some divines, that the Calpa formerly consisted only of nine Manwantaras, each of which contained, as at present, 71 Mahayugs: but as it does not enter into the plan of this article to enter into the Cosmogony or Theology of the Hindus, I only mention it with a view to a few remarks on the names of the fourteen patriarchs or Manus, whose anniversaries are now kept, and whose names I shall give, because they are little known; stating at the same time, the Lunar months, Pacshas, and Tidhis on which they are respectively observed.

The 14 Manus.

| Names and number of Manus. |                   |        | 11 €         | Tidhis on | which observed. | Lunar months.      | Pacehas  |
|----------------------------|-------------------|--------|--------------|-----------|-----------------|--------------------|----------|
| Mai                        | nes and number of | *11411 | u <b>.</b> . | Numeral.  | Names.          | Lunar months.      | Pacsaas, |
| 1                          | Swáyambhuva       |        | _            | 12        | Duadesi         | Cartiga            | Sucha.   |
| 2                          | Swarochisha       | -      | -            | 9         | Navami          | Aswina             | Do.      |
| 3                          | Uttama -          | -      | -            | 3         | Tritia          | Chaitra            | Do.      |
| 4                          | Támasa -          | -      | -            | 3 1       | Tritia -        | Bhádrap <b>ada</b> | Do.      |
| 5                          | Rayvata -         | -      | -            | 11        | Yeckadesi       | Paushia.           | Do.      |
| 6                          | Icshwacu -        | _      | •            | 10        | Desami          | A'shád'ha          | Do.      |
| 7                          | Vaywaswata        | -      | -            | 17        | Septami         | Magha              | Do.      |
| 8                          | Brahma Sávarni    | •      | -            | 15        | Pavuraami       | Phalguna           | Do.      |
| 9                          | Rudra Sávarní     | -      | -            | 8         | Astami          | A'shád'ha          | Christn: |
| 10                         | Dacsha Savarni    | -      | -            | 8         | Astanii         | Cartiga            | De.      |
| 11                         | Agui Sávarni      | -      | -            | 30        | Amavasya Th.    | Sravana            | Do.      |
| 12                         | Súrya Savarni     | -      | -            | 8         | Astami          | Bhádrapada         | Do.      |
| 13                         | Rouchya -         |        | -            | 15        | Pournami        | Chaitra            | Sucha.   |
| 11                         | Bhouchya -        |        |              | 15        | Pavurnami [     | Jy aishtá          | Do.      |

Among the names of the patriarchs, it is remarkable that five bear the additional one of Sávarni; that the name of the 8th is Brahma, the 9th Rudra (the same as Siva), and that the 12th bears the name of the Sun. Whether Dacsha the 10th refers to Vishna, and Agni the 11th to the Moon, I do not pretend to know; but this seems possible, from the quality, and arrangement of the five which bear the cognomen of Sávarni. If so, it would be a strong indication

The remaining anniversaries, as has already been stated, are those of the ten incarnations of Vishnu (\*) and of the Gowries, on which the Vritham is kept; but I am not sufficiently versed in Hindu Mythology, nor have I space enough at command, to give a specific account of their nature, names, and dates of observance.

that (since three bear evidently no patriarchal names) the whole have been interpolated.

Remark on their number and names.

The 10 incarnations of Vishna.

Fasts of the Gowries.

<sup>(\*)</sup> There are ten names under which Vishnu appears in the Kalendar, viz. 1, Matsya deva. 2, Coorma, 3, Varaha. 4, Narasimba. 5, Vamanu. 6, Parasurama. 7, Sri-rama. 8, Bala-rama. 9, Sri-kri-hna. 10, Cali or Calki, according as he assumed the aspect of a Fish, a Tortoise, a With Hog, Lion and Man, a Dwarf, a Brahmin, a Cshetria, a Shepherd, and a Horse with a human face. Of the Gowries, I am told the number is considerable.

Local holy days. Feasts of the principal pagodas in the neighbourhood.

The Panchangum also notices the local holy days, and the feasts of the most considerable pagodas, situated about 100 miles around the place for which the Kalendar is computed; besides other items of a religious, or superstitious nature (feasier an idolatrous religion may know these distinctions), which will be easily understood when met with in the Kalendar, and therefore need not be enumerated.

Civil articles.

Duration of the artificial days and nights.

Prediction of abundance and scarcity.

Rural occupations.

Lastly: There will be found in the margin of the Panchangum certain articles of a civil description, such as the length of the artificial solar days, and nights, indicated at least once in the course of the month; the Sun's entrance into the different Signs of the Tropical Zodiac, and those predictions, of abundance (Vridhiarga), middle state of prosperity (Samarga), and of scarcity (Sooniarga), intended to point out the proper seasons for rural occupations; just in the same manner as these contingencies were formerly announced in a far famed Almanac, published at Liege, under the fictitious name of Mathicu Landsberg, which sold for six pence throughout the Continent of Europe, and might have vied with, and perhaps excelled, the Indian Patras, in the absurdity of its articles.

#### NOTE.

All the articles of the Hindu Ephemerides inserted in the Patras, are given in an abridged form; and are so contracted, that what fills five pages in the translation, is contained in one of the original. In the Peninsula, the Ravi Panchangum, is generally published in the Tamul idiom; and the Chandra Panchangum, in the Teloogoo: on which account they are known by the name of the Tamul, and Teloogoo Kalendars.



A translation of the first page of the Tamul Solar Kalendar (Ravi Panchangum) for the year of the Califug 4926 current, answering to A. D. 1824, computed in Solar time and with the Elements given in the Aria Siddhanta for the Latitude and Meridian of Fort St. George.

Years of the Califug clapsed 4925. From the birth of Salivahana 1746. Of the Æra Vicramaditya 1881. Of the Vrihaspati Chacra, Tellinga account, Tarana (the 18th). Do. Benares account, Manmat'ha (the 29th). Of the Grahaparivrithi or Cycle of 90 years, the 48th.

KALENDAR.

| MONTH | CHATTRAM | (Rengal | Vaisácha). |
|-------|----------|---------|------------|
| MUNIA | CHAILKAM | Densar  | vaisachaj. |

European|Theidi ot Ferix. Tamul date. Ephemerides. date. April. 1 Sanday. Triodesi (the name of the concurrent Lunar Tidhi) it's end 475 20v (after apparent 11 time of Sun rising) - D in Nacshatra Purva Phalguni, passes to the next at 3g 33v-Yogù Vriddhi (the 11th) ends at 25 50v Do. Dhrava (12th) ends 53g 5v Curna Coulava (the 3d) ends 19g 50v-Thyagum of Wurjum, Devi (day time) begins at 203 41v-Mesha Vishuvat (indicating that certain religious ceremonies which depend on the recurrence of the Vernal Equinox are to be performed .- Samarga (mean state of agricultural prosperity—time proper for sowing the fields)—Ahus (or Dinarda duration of the artificial day) 303 40v-Mercury enters the second D. 1824. APRIL. Padah (quarter) of Nacshatra Aswini at 54g-Jupiter enters the third Padah of Nacshatra A'rdrà 16g-Mars' Crantum in Nacshatra Purva Phalguni (no marriage ceremonics on account of the Crantum).—The Sun and Rahu (D's & are Latta... Soonia (state of unfavourable prospects) no Srardum (ceremonies for deceased ancestors; - Madana Triodesi (the last day of a festival begun before). Chaturdasi, ends at 42g 53v D in Nacshatra Uttara Pholyuni, ends at Cg 23v\_ 2 Monday. 12 Bhadrapada 155-No ceremonies allowed on this day. Purnima Tidhi (day of full Moon), ending at time of apparent epposition, which Tuesday. 13 3

passes on the same Tidhi into Nacshatra Hasta, ends 575 33v-Yogu Vyagatha (13th) ends 49g 43v\_Curna Garujah or Yurka (5th) ends 15g 6v\_Thyagum of Wurjum, begins 218 34v-Venus enters 1st Padah (quarter) of Nacshatra Uttara

occurs at 395 169-) in Nacshatra Chitra, end 565 26v-Yogù Hershana (14th) ends 44s 5v\_Curna Bhadra (7th) ends 11s 5v\_Thyagum of Wurjum, Devi (day time) begins 17s 30v\_Mercury enters 3d Padah of Nacshatra Aswini at 41s\_Mars is Latta-Accession of Rouchya Manu one of the fourteen presiding spirits of the

|         | h               | ALENDAR.                    |           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------|-----------------|-----------------------------|-----------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| F       | date,<br>April. | Theidi or<br>Tamul<br>date. | Feriæ.    | Vaisácha, or Chaitram, continued. Ephemerides.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
|         | 14              |                             | ₩ ednesd. | Calpa divided into 14 Manwantaras)—Chaitra Purpima (day of full Moon in Chaitram) a Tidhi of general observances and ceremonics.  Christna Pacsha (the dark half of the month) Padyami (1st Tidhi of the said Pacsha) ends 36g 41v—D in Nacshatra Swati, ends 55g 50v—Yogù Vajia (15th) ends 39g 13v—Curna Bhalava (2d) ends 7g 53v—Thyagum of Wunjum, Devi (d. t.) begins 10g 18v—Sun enters 2d Padah of Nacshatra Aswini 16g 21v—Venus enters 2d Padah of Nacshatra Uttara Bhadrapada, 58g—Saturn enters 3d Padah of Nacshatra Criticà 34z. |
|         | 15              | 5                           | Thursday  | Duitia T. ends 35g 0v—D in Nacshatra Visac'ha, ends 56g 24v—Yogù Siddhi or Asrij (16th) ends 35g 20v—Curna Dhitala (4th) ends 5g 51v—Thyagum of Wurjum, Devi (d. t.) begins 9g 58v—Mercury enters 4th Padah of Aswini 34g.                                                                                                                                                                                                                                                                                                                    |
|         | 16              | 6                           | Friday.   | Tadya T. ends 3 lg 41v_) in Nacshatra Anurádhá, ends 58s 13v_Yogù Vyatipáta (17th) ends 32s 24v_Curna Warnaji (6th) ends 4s 51v_Thyagum of Wurjum, Devi (d. t.) begins 6s 42v_Garoolavahana, Triplicane feast.                                                                                                                                                                                                                                                                                                                                |
| AL WITE | 17              | 7                           | Saturday. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|         | 18              | 8                           | Sunday.   | Punchami T. ends 37g 50v— p in Nacshatra Jyést'ha ends 1g 17v—Yogù Parigha (19th) 29g 18v—Curna Coulava (3d) ends 6g 46v—Thyagum of Wurjum, Devi (d. t.) begins 22s 43v—Matsya deva (anniversary of Vishnu's incarnation as a Fish).                                                                                                                                                                                                                                                                                                          |
|         | 19              | 9                           | Monday.   | Shusti T. ends 415 10v _ ) in Nacshatra Mula, ends 5g 36v _ Yogù Siva (20th) 295 35v _ Curna Garnjah (5th) ends 9g 30v _ Thyagum of Wurjum, Devi (d. t.) begins 1g 20v _ 2d Thyagum, Ratri (night time) begins 0g 47v _ Mercury enters 2d Padah of Bharani 19g.                                                                                                                                                                                                                                                                               |
|         | 20              | 10                          | Fuesday.  | Septami ends 45g 30v— D in Furva A'shad'ha, ends 10g 53v—Yogu Siddha (21st) ends 30g 22v—Curna Bhadta (7th) ends 13g 20v—Thyagum of Wurjum, Ratri (n. t.) begins 1g 55v—Mercury visible, West 26g—Venus enters 4th Padah of Nacshatra Uttara Bhadrapada 24g—Rahu ()'s \(\Omega\)) Crantum in Nacshatra Purva A'shad'ha.—Rahtot Savam, feast of the great chariot in Triplicane.                                                                                                                                                               |
|         | 21              | 11                          | Wednesd   | Astami T. ends 50g 16v ) in Nacshatra Uttara A'shad'ha, ends 16g 55v Yogu Sadhya (22d) ends 31g 52v Curna Bhalava (2d) ends 17g 53v Thyagum of Wurjum, Devi (d. t.) begins 27g 58v Sun enters 4th Padah of Nacshatra Aswini 6s 10v Sun also enters the Tropical Zodiacal Sign Vrisha & at 14g 35v Mercury enters 3d Padah of Nacshatra Bharaniat 12g Ahus (duration of artificial day) 31g.                                                                                                                                                   |

|                             | KALENDA               | R.        |                                                                                     |
|-----------------------------|-----------------------|-----------|-------------------------------------------------------------------------------------|
| European<br>date,<br>April. | Theidi of Tamul date. | Feriæ.    | Vaisácha, or Chaitram, continued. Ephemerides.                                      |
| 22                          | 12                    | l'harsday | Navami T. 555 17v                                                                   |
|                             |                       | 1         | Ov_Curna Dhitala (4th) 22g 45v_Thyagum of Wurjum, Ratri (night time) 3s 20          |
|                             | }                     |           | —Satrica Vethei (no marriage ceremonies).                                           |
| 23                          | 13                    | Friday    | Desami T. 60g-) in Nacshatra Dhanish'tà 20g 43v-Yogù Subra (24th) 34g 20            |
|                             |                       |           | —CurnaWarnajee (6th) 27g 47v—Thyazum of Wurjum, Ratri (night time) 18g 27v—         |
|                             |                       |           | Mercury enters 4th Padah of Nacshatra Bharani 4g-Venus enters 1st Padah of Revati   |
|                             |                       |           | 7gThis Tidhi (Desami) is Adigah, being repeated and called Tridina Sprohoo.         |
| 24                          | 14                    | Saturday  | Desami T. 0g 16v in Nacshatra Satabhisha 35g 12v-Yogù Brahman (25th)                |
|                             |                       |           | 355 27 - Curna Bhuddrava (7th, only one in advance from the last instead of two, on |
|                             |                       |           | account of the day being repeated) 08 16v Thyagum of Wurjum, Ratri (night time)     |
|                             |                       |           | 225 2v Sun enters 1st Padah of Nacshatra Bharani 32g 42v Mercury enters 1st         |
|                             |                       |           | Padah of Nacshatra Critica 57g.                                                     |
| 25                          | 15                    | Sunday    | Yecadesi T. 4g 35v ) in Nacshatra Parva Bhadrapada 41g 3v Yogu Maha                 |
|                             |                       | i<br>     | Indra (26th) 36g—Curna Bhalava (2d) 4g 35v—No Thyogum of Wurjum—Venus               |
|                             |                       |           | euters second Padah of Nacshatra Revati 505-Ketu (D's 8) is Latta. A general        |
|                             |                       |           | fast, the men's foreheads to be painted according to castes.                        |
| 26                          | 16                    | Monday    | Duodesi T. 8g 0v_D in Nacshatra Uttara Bhadrapada 45g 25v_Yogu Vaidrithi            |
|                             |                       |           | (27th) 355 50v_Curoa Dhitala (4th) 85 0v_Thyagum of Wurjum, Devi (day time)         |
|                             |                       |           | 6s 48v Mars ceases to be retrograde and begins to proceed direct 42g Mercury        |
|                             |                       |           | enters 2d Padah of Nacshatra Critica in Vrisha 8 56g-Varaha Jyanti's birth day.     |
| 27                          | 17                    | Tuesday   | Triodesi T. 10g 18v. ) in Nacshatra Revati 485 36vYogù Vishcambha (1st)             |
|                             |                       |           | 34g 43v—Curna Warnajee (6th) IOg 18v—Thyagum of Wurjum, Devi (day time) 17g         |
| İ                           |                       |           | 1v-Sun enters 2d Padah of Nacshatra Bharani 59g 2v-Mars is Vethei (no marriage      |
| į                           | į                     |           | ceremonies; the Srardum or observance for the dead as usual).                       |
| 28                          | 18                    | Wednesd.  |                                                                                     |
|                             |                       |           | 35v—Curna Soyami or Shakoni (3th) extraordinary 11s 20v—Thyagum of Wurjum.          |
|                             |                       |           | Ratri (night time) 93 84-Venus enters 3d Padah of Nacshatra Revati 33s.             |
| 29                          | 19                    | Thursday  | Amavasaya or conjunction day (being the 30th Tidhi of the Lunar month and the       |
|                             |                       |           | last or 15th of the Christna Pacsha) 11g 10v_D in Nacshatra Bharani 51g 18v         |
|                             |                       |           | Yogu Ayushmat (3d) 20g 28v Curna Nayava (10th extraordinary) 11g 10v                |
|                             |                       |           | Thyagum of Wurjum, Devi (day time) 14s 50v Mercury enters 3d Padah of Nac-          |
|                             |                       |           | shatra Critica 3g.—Sun's Crantum in Nacshatra Bharani. On Amarasaya or con-         |
| į                           |                       | _         | junction, a general observance of principal rites.                                  |
| 30                          | 20                    | Friday    | Padyami or Prathama Tidhi (1st of the Sucha Pacsha or culightened half of the       |
| ,                           | ļ                     |           | Lunar month) 9g 46v_) in Nacshatra Critica 50g 53v_Yogù Saubhágya (4th)             |

APRIL.

|                            | KALUNDAR       |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|----------------------------|----------------|----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Europea i<br>date,<br>May. | Tamul<br>date. | Feriæ.   | Vaisácha, or Chaitram, continued. Ephemerides.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| May<br>1                   | 21             | Saturday | 25; 30v—Curna Bhava (1st) 93 46v—Thyagum of Wurjum, Devi (day time) 218 8v—Saturn sets West 37s, his Crantum (no marriage ceremony)—This day is the 1st of the Luni-solar month of the Tellingas—The Moon's crescent begins to appear this evening at Sun set, and the Mahommedan Civil month Ramzan commences.  Duitya or Vidya 7s 13v—) in Nacshatra Rohini 49s 42v—Yogù Sóbhana (5th) 20g 32v—Curna Coulava (3d) 7s 13v—Thyagum of Wurjum, Devi (day time) 30g 6v—Sun enters 3d Padah of Nacshatra Bharani 25s 45v—Mercury enters 4th Padah of       |
| 2                          | 22             | Sunday   | Nacshatra Critica 21g—Venus enters 4th Padah of Nacshatra Revati 16g—Tritu yuga dina, or anniversary of the day on which the Trita yug began—Birth day of Balaram Deo.—Acshaya Tritya (the current Tidhi), a lucky day.  Tritya T. 3g 41v—The next Lunar Tidhi, called Chouti, is a Cshaya or expunged one (and therefore intervening between Tritya and Punchami) ends at 55g 32v—) in Nacshatra Mrigasiras 47s—Yogù Atiganda (6th) 14g 51v—Curna Yurka (5th) the                                                                                      |
| 3                          | 23             | Monday   | same as Garujee 3g 41v—Second Curua (on account of expunged Tidhi) Vurnaja (6th) 27g 16v—Thyagum of Wurjum, Devi (day time) 3g 5v—Ahus (duration of artificial day) 31g 15v—This is marked Avamaha on account of the expunged Tidhi.  Punchami T. 51g—) in Nacshatra A'rdrà 43g 54v—Yogù Sucarna (7th) 8g 26v—Curna Bhava (1st) 26g 37v—Thyagum of Wurjum, Devi (d. t.) 6g 52v—Mercury enters 1st Padah of Nacshatra Rohini 42s—Jupiter enters 4th Padah of Nacshatra A'rdrà 52g—Venus enters 1st Padah of Aswini in Mesha $\gamma$ 59g—Ketu's ()'s 99) |
| 4                          | 24             | Tuesday  | Crantum (no marriage ceremonies)—Sun's Vethei—Streepermadore feast—Yembramanu's birth day.  Shasti T. 48g 237— in Nacshatra Punarvasu 40g 14v—Yogù Dhriti (8th) 1g 31v—the next Yogù Sûla (9th) 52g 42v—Curna Coulava (3d) 31g 12v—Thyagum of Wurjum, Devi (day time) 12g 4v—2d do. Ratri (night time) 27g 387—Sun enters 4th Padah of Nacshatra Bharani 52g 14v.                                                                                                                                                                                       |
| 5                          | 25             | Wednesd  | Septemi T. 423 32v) in Nacshatra Pushia 368 18vYogù Ganda (10th) 453 38vCurna Garujee (5th) 158 28vShesha (complement of) Thyagum 28 54v                                                                                                                                                                                                                                                                                                                                                                                                                |
| 6                          | 26             | Thursday | Ov_Curna Bhuddra (7th) 95 30v_Thyagum of Wurjum, Devi (day time) 65 10v_                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| 7                          | 27             | Friday.  | Mercury enters 2d Padah of Nacshatra Rohini 11g—Venus enters 2d Padah of Nacs.  Aswini 42g.  Navami T. 30g 30v—) in Nacshatra Maghà 28g 14v—Yogù Dhruva (12th)  31g 25v—Curna Bhalava (2d) 3g 29v—Thyagum of Wurjum, Devi (day time)  Og 15v—2d Do. Ratri (night time) 15g 36v—Saturn's Latta.                                                                                                                                                                                                                                                          |

|          | i                         | ALENDAR                     | •         |                                                                                  |
|----------|---------------------------|-----------------------------|-----------|----------------------------------------------------------------------------------|
|          | European<br>date,<br>May. | Theidi or<br>Tamul<br>date. | Feriæ.    | Vaisácha, or Chailram, continued. Ephemerides.                                   |
|          | 8                         | 28                          | Saturday. | Desami T. 24g 46v. ) in Nacshatra Purva Phalguni 24g 25v. Yogu Vyágháta          |
|          |                           |                             |           | 24g 7v Curna Garujee (5th) 24g 46v Thyagum of Wurjum, Ratri (night time)         |
|          |                           |                             |           | 10g 1v_Sun enters 1st Padah of Nacshatra Critica 18g 56v_Mercury enters 3d       |
|          |                           |                             |           | Padah of Nacshatra Rohini 45g N. B. On Desami Tidhi the Srardum (ceremony        |
|          |                           |                             |           | for deceased ancestors) to be observed.                                          |
|          | 9                         | 29                          | Sunday.   | Yacadesi T. 19g 34v_ ) in Nacshatra Phalguni 21g 8v_Yogù Hershana (14th)         |
| <u>:</u> | İ                         |                             |           | 17s 10v_Curna Budhrava (7th) 19g 34v_Thyagum of Wurjum, Ratri (night time)       |
| 7        |                           |                             |           | 10g 35v Venus enters 3d Padah of Nacshatra Aswini 25g Saturn enters 4th Padah    |
| Ì        | 1                         |                             |           | of Nacshatra Critica 59g_Mercury's Crantum_Rahu's ()'s &) Latta.                 |
| İ        | 10                        | 30                          | Monday.   | Duadesi T. 15g 6v) in Nacshatra Hasta 18g 34vYogù Vajra (15th) 10g 45v           |
| İ        |                           |                             |           | Curna Bhalava (2d) 15g 6v-Thyagum of Wurjum, Ratri (night time) 6g 30v-          |
|          | • •                       |                             |           | N. B. The ceremonies suspended on Tryadesi, the 1st day of this Solar month,     |
| İ        | İ                         | -                           |           | (Mesha masa or month of Aries) to be performed on this day.                      |
|          | 11                        | 31                          | Tuesday.  | Tryadesi T. 11g 20v_) in Nacshatra Chitra 16g 46v_Yogù Asrij or Siddh?           |
|          |                           |                             |           | (16th) 5g 0v-next Yogù Vyatipáta (17th) 54g 55v-Curna Dhitala (4th) 11g 20v-     |
| ļ        | ŀ                         | 1                           |           | Thyagum of Wurjum, Devi (day time) 30g 34v_Sun enters 2d Padah of Nacshatra      |
|          | į                         |                             |           | Citicà, in the Solar Sign Vrisha & 46s 47v Mercury enters 4th Padah of Nacshatra |
|          |                           |                             |           | Rohini 275 Sun and Mars' Latta. N. B. The ceremonies suspended on                |
|          |                           |                             |           | Chaturdesi to be performed on this day.                                          |

End of the Solar month Chaitram, or Vaisácha.



A translation of the first page of the Tellinga Kalendar (Siddhanta Chandra mana) for the Luni-solar year 4026 commencing, answering to the 1747th of the Era of Salivahana; the expired years of the former being the 4925th, and of the latter the 1746th; and of the Era Vicramaditya the 1881st, all corresponding to the year of Christ 1824. The name of the current year of the Cycle of 60 (Vrihaspati) being Tarana, according to Tellinga account; and Manmatha, Benares reckoning. Computed with the Elements of the Surriah Siddhanta for the Meridian and Latitude of Fort St. George.

|            | KALE                                               | NDAR.                             |          |                                                                                                                                                                                                                                                                         |
|------------|----------------------------------------------------|-----------------------------------|----------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| European   | Solardate,<br>Tamul<br>Poongoni<br>or<br>Chaitram. | Chaitra,<br>Luni-so-<br>lar date. | Feriæ.   | Lunar Month Chaitra, the first of the Luni-solar year. Ephemerides.  Sucha Pacsha, or enlightened half of the month.                                                                                                                                                    |
| 31         | 20                                                 | 1                                 | Wednes.  | End of Tidhi 36g 3v-Moon in Nacshatra Revati, passes to the next at                                                                                                                                                                                                     |
|            | Tropical<br>Zodiacal<br>Sign Me-<br>sha Y          | _                                 |          | 27g 31v—Yogù Maha Indra (26th) ends 14g 18v—Curna Khimostogana (11th) ends at 5g 43v—No Thyajum of Wurjum—Sun enters 2d Fadah (quarter) of Nacshatra Revati, at 46g 34v—Sun's Crantum—Mars' Vethei- —Annual fast of Samvatsara Gowry Vritham (bathing and other rites). |
| April<br>1 | 21                                                 | 2                                 | Thursday | -                                                                                                                                                                                                                                                                       |
| 2          | 22                                                 | 3                                 | Friday   | End of Tidhi 35g 17v— D in Nacshatra Bharani, passes to the next at 30g 15v—Yogù Vishcambha (1st) ends at 9g 7v—Curna Dhitala (4th) ends 5z 48v—Thyajum of Wurjum, none—Accession of Uttama Manu (Patriarch)—Vritham or fast of Gowri Sow baghia.                       |
| 3          | 23                                                 | 4                                 | Saturday | End of 'T. 33g 6v) in Nacshatra Critica 29g 50v                                                                                                                                                                                                                         |
| 4          | 24                                                 | 5                                 | Sunday   | End of T. 29g 50v_D in Nacs. Rohini, passes 285 25v_Yogù Sau-bhágya (4th) ends 54g 10v_Curna Bhava (1st) ends 15 27v_Thyajum of Wurjum, Devi begins 85 54v_Do. Ratri 18g 25v_Sun enters 3d Padah of Nacshatra Revati 95 57v_Mercury enters 2d Padah of Revati 05 0v_    |

|        | KALE                        | NDAR.    |          |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------|-----------------------------|----------|----------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| April. | Peongoni<br>or<br>Chaitram. | Chaitra. | Feriæ.   | Chaitra, continued. Ephemerides.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 5      | 25                          | 5        | Monday   | Venus enters 2d Padah of Purva Bhadra 5g_Culpa dia, anniversary of the beginning of Culpa.  End of T. 25g 46v_D in Nacshatra Mrigasiras (5th) issues at 26g 7v_Yogù Sóbhana (5th) ends 47g 42v_Curna Dhitala (4th) ends 25g 46v_I'hyajum of Wurjum, Ratri begins 15g 32v_Tidhi Shusti, on which there                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| €      | 26                          | 7        | Tuesday  | is Srardum, or ceremonies for the dead.  End of Tidhi 20g 51v— ) in Nacshatra A'rdrd (6th) issues 23g 1v—Yogd.  Atiganda (6th) ends 40s 43v—Curna Warnajee (6th) ends 20g 51v—Thya- jum of Wurjum, Ratri begins 20g 43v—Mercury enters 3d Padah of Nacshatra Revati 31g—Venus enters 3d Padah of Nacs. Rurva Bhadrapada:  at 38g—Ketu's ()'s 93) Crantum—Sun's Vethei—Tidhi Duitia—Santara                                                                                                                                                                                                                                                                                                                                               |
| 7      | 27                          | 8        | Wednesd  | Septami; ceremonies for the dead, (meaning that the ceremonies which ought to have been performed on the 2d Tidhi are postponed until this day.)  End of Tidhi 15g 27v ) in Nacshatra Punarvasu (7th) issues 19g-25v Yogù Sucarman (7th) ends 32g 21v Curna Bhava (1st) ends 15g 27v Thyajum of Wurjum, Ratri begins 7g 35v Sun enters 4th Padah of Nacshatra Revati at 33g 38v Navami Tidhi Srardum ceremonies for                                                                                                                                                                                                                                                                                                                      |
| 8      | 28                          | 9        | Thursday | the dead—Sri Ram's birth day.  End of Tidhi 9g 33v— ) in Nacshatra Pushia 15g 27v—Yogù Dhriti (8th) 25g 40v—Curna Coulava (3d) 9g 33v—Thyajum of Wurjum, Ratri (night time) begins 14g 42v—Mercury enters 4th Padah of Nacshatra                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| 9      | 29.                         | 10       | Friday   | Revati 20g.  End of Tidhi 3g 29v—Oppadi (expunged) Tidhi, ends 54g Ov, its name Yacadesi—) in Nacshatra Aslesha 11g 18v—Yogu Sula (9th) 18g 1v—Curna Garujah (5th) 3g 29v—2d Curna (of the expunged                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| 10     | 30                          | Cshaya.  | Saturday | day) Warnajee (6th) 27g 0v—Thyajum of Wurjum, Ratri (night time) 8g 31v—Mars retrograde, enters 2d Padah of Nacshatra Phalguni 8g—Venus enters 4th Padah of Nacs. Purva Bhadrapada in the Solar Sign Min × 31g—On account of the Oppadi, or Avamaha Tidhi Yacadesi, the distinguishing marks of castes to be generally painted on the forehead.  End of Tidhi 51g 50v—D in Nacshatra Maghà 7g 10v—Yogù Ganda (10th) 10g 25v—Curna Bhava (1st) 24g 40v—Thyajum of Wurjum, Devi (day time) 25g 24v—Sun enters 1st Padah of Nacshatra Aswini and the Sign of the fixed Zodiac Mesha at 57g 43v—Mercury enters 1st Padah of Nacshatra Aswini in the Sign Mesha at 6g—Saturn's Latta—This Tidhi Yacadesi, a fast for the followers of Vishnu. |

|        | KALE                            | NDAR.    |          |   |
|--------|---------------------------------|----------|----------|---|
| April. | Chaitram<br>  or<br>  Vaisácha. | Chaitra. | Feriæ.   | S |
| 11     | 1                               | 13       | Sunday   |   |
|        |                                 |          |          |   |
|        |                                 |          |          |   |
|        |                                 |          |          | T |
|        |                                 |          |          | 1 |
|        |                                 |          |          | c |
|        | Ì                               |          |          | j |
|        |                                 |          |          | F |
| 12     | 2                               | 11       | Monday   |   |
|        |                                 |          |          | , |
|        |                                 |          |          | 1 |
|        | -                               | _        |          |   |
| 13     | 3                               | 15       | Tuesday  | ; |
|        | 1                               | }        |          | j |
|        |                                 |          |          |   |
|        |                                 | •        | ľ        | ( |
|        |                                 | Pacsha.  |          | • |
| 14     | 4                               | 1        | Wednesd. |   |
|        |                                 |          |          |   |
|        |                                 |          |          | • |
|        |                                 |          |          | 1 |
|        |                                 | 1        |          |   |
| 15     | 5                               | 2        | Thursday | [ |
|        | į                               |          |          | 9 |
|        |                                 |          |          | ( |
|        |                                 |          | İ        | ( |
| 16     | 6                               | 3        | Friday   |   |
| !      |                                 |          |          |   |
|        |                                 |          |          | ( |
| 17     | 7                               | 4        | Saturday |   |
| 1      |                                 |          |          |   |

Chaitra, continued. Ephemerides.

Sucha Pacsha ends. Christna Pacsha (or dark half of the month) begins,

End of Tidhi 46g 24v— D in Nacshatra Purva Phalguni erds 3g 18v—Do. in Uttara Phalguni ends 56g 41v—Yogù Vriddhi (11th) ends 2g 57v—Do. Dhruva (12th) ends 53g 0v—Curna Coulava (3d) ends 19g 5v—Thyajum of Wurjum, Devi (day time) begins 20g 19v—Mercury enters 2d Pada of Nacshatra Aswini 54g—Jupiter enters 3d Padah of Nacs. A'rdrà 16g—Mars' Clantum—Sun and Rahu's (D's &) Clantum (no marriage ceremony)—Vishuvat Paniacala (certain ceremonics recurring about the Equinoxes to be performed)—Samarga (middle state of agricultural prosperity) time for sowing the fields.

End of Tidhi 41s 43v — ) in Nacshatra Hasta ends 57g 22v—Yogù Vyágháta (13th) 49g 25v—Curna Garujee (5th) ends 14g 5v—Thyajum of Wurjum, Devi (day time) begins 21g 2v—Venus enters 1st Padah of Nacshatra Uttara Bhadrapada 15g.

End of Tidhi 37s 32v—p in Nacshatra Chitra ends 55s 16v—Yogù Hershana (14th) ends 43z 27v—Curna Bhadra (7th) ends 9g 30v—Thya. jum of Wurjum, Devi (day time) begins 16g 31v—Mercury enters 3d Padah of Nacs. Aswini 44g—Mars' Latta—Accession of Rouchya Manu (the 13th of the 14 Rulers of the Calpa)—Chitra Purnima Tidhi, (the Lunar day of opposition or full Moon) general observances.

End of Tidhi 34g 23v ) in Nacshatra Swáti, ends 54g 19v Yogù Vajra (15th) ends 38g 21v Curna Bhalava (2d) ends 5g 55v Thyajum of Wurjum, Devi (day time) begins 8g 58v Sun enters 2d Padah of Nacshatra Aswini 21g 51v Venus enters 2d Padah of Uttara Bhadrapada 58g Saturn enters 3d Padah of Nacshatra Criticà 34g Beginning of the Triplicane feast. The Christia Pacsha (obscure half of the mouth) begins.

End of Tidhi 32g 25v. D in Nacshatra Visac'ha, ends 54g 34v. Yogù Siddhi (16th) ends 34g 10v. Curna Dhitala (4th) ends 3g 24v. Thyajum of Wurjum, Devi (day time) begins 8g 23v. Mercury enters 4th Padah of Nacshatra Aswini 34g.

End of Tidhi 31g 44v—) in Nacshatra Anurádhà, ends 56g 0v—Yogù Vyatipata (17th) ends 30g 56v—Curna Warnajce (6th) ends 2g 5v—Thyajum of Wurjum, Devi (day time) begins 4g 48v—Triplicane feast continues—Procession of Gurulatsavam.

End of Tidhi 32s 15v\_) in Nacshatra Jyést'ha ends 58s 42v\_Yogû Vari'yas (18th) ends 28s 39v\_Curna Bhava (1st) ends 2s 0v\_Thyajum

| 1      | KALL                                     | NDAR.    |           | City to a second to the First second to                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|--------|------------------------------------------|----------|-----------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|        | Chaitram                                 | G        |           | Chaitra, continued. Ephemerides.                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| April. | or<br>Vaisácha.                          | Chaitra. | Feriæ.    | Christna Pacsha.                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| 18     | 8                                        | 5        | Sanday    | of Wurjum, Devi (day time) 10g 38v_Sun enters 3d Padah of Nacshatra Aswini 46g 22v—Mercury enters 1st Padah of Nacshatra Bharani 26g_ Venus enters 3d Padah of Nacshatra Uttara Bhadrapada 41g.  End of Tidhi 34g 10v_) in Nacshatra Mula ends 60g_Yogù Parigha (19th) ends 27g 30v_Curna Coulara (3d) 3g 12v_Thyajum of Wur- jum, Devi (day time) begins 20g 0v_2d Thyajum, Ratri (night time) begins 27g 30v_Matsya deva's day, (anniversary of Vishnu's incarnation as |
| 19     | 9                                        | 6        | Monday    | a Fish).  End of Tidhi 375 9v— in Nacshatra Mula ends 2g 36v—Yogù Siva (20th) ends 27g 11v—Curna Garujec (5th) 5g 40v—Complement of Thyajum (the Moon having left the Nacshatra Mula on the preceding day at 60 guddias complete) called Shesha, Devi (day time) 2g 21v—2d Thyajum, Devi (day time) begins at 28g 35v—Mercury enters 2d Padah of Nacshatra                                                                                                                |
| 20     | 10                                       | 7        | Tuesday.  | Siddha (21st) ends 27g 42v—Curna Bhudia (7th) begins 9g 7v—Thyajum of Wurjum, Devi 29g 28v—Mercury visible in the West at 26g—Venus enters 4th Padah of Uttara Bhadrapada at 24g—Rahu's ()'s &) Crantum in Purva A'shád'hà—Ketu's Vethei—Rahtot Savam (feast of the great                                                                                                                                                                                                 |
| 21     | Tropical<br>Zodiacal<br>Sign<br>Vrisha & |          | Wednesd.  | Chariot) in Triplicane.  End of Tidhi 133 16v) in Nacshatra Uttara A'shád'hå, issues 13g 21v  Yogù Sádhya (22d) ends at 28g 47vCurna Bhalava (2d) ends 13g 26v  Thyajum of Wurjum, Devi begins 24g 25vSun enters 4th Padah of Nacshatra Aswini at 12g 40vSun enters the Tropical Sodiacal Sign Vrisha & at 21g 25vMercury enters 3d Padah of Nacshatra Bharani at 12gAhus (Dinarda, or duration of artificial day) 31g 0v.                                                |
| £2     | .12                                      | 9        | Chursday  | Tidhi ends at 50g 55v_) in Nacshatra Sravana, issues 19g 44v_<br>Yogù Subha (23d; ends 30g 12v_Curna Dhitala (1th) 18g 20v_Thyajum<br>of Wurjum, Ratri begins 30g 50v_Saturn's Vethei.                                                                                                                                                                                                                                                                                    |
| 23     | 13                                       | 10       | Friday.   | Tidhi ends 55g 57v ) in Nacshatra Dhanish'tà, issues 26g 18v Yogà Subra (24th) ends 31g 48v Curna Warnajee (6th) ends at 23g 26v Thyajum of Wurjum, begins 15g 10v Mercury enters 4th Padah of Nacshatra Bharani at 4g Venus enters 1st Padah of Nacshatra Revati at 7g.                                                                                                                                                                                                  |
| 24     | 14                                       | 11       | Saturday. |                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

|        | KALES                          | DAR.             |          | Chaitra, continued. Ephemerides.                                                                                                                                                                                                                                                                                                                                               |
|--------|--------------------------------|------------------|----------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| April. | Chaitram<br>  or<br> Vaisácha. | Chaitra          | Feriæ.   | Christna Pacsha.                                                                                                                                                                                                                                                                                                                                                               |
|        | 1                              | Adigah<br>Tidhi. |          | Brahman (25th) ends at 33g 7v—Curna Bhava (1st) ends 28g 15v—Thyajum of Wurjum, Ratri begins at 18g 57v—Sun enters 1st Padah of Nacshatra Bharani, at 39g 22v—Mercury enters 1st Padah of Nacshatra Critica at 57g—Tridina Sproohoo (the meaning of which is that the Lunar Tidhi Chaturdasi is repeated.)                                                                     |
| 25     | 15                             | 11               | Sunday.  | Tidhi ends at 0g 34v_) in Nacshatra Purva Bhadrapada, issues at 38g 3v_Yogù Maha Indra, ends at 33g 48v_Curna Bhalava (2d) ends 0g 34v_Thyajum of Wurjum, none_Venus enters 2d Padah of Nacs. Revati at 50g_Ketu's (D's 8) Lutta_a general fast_the men's foreheads to be painted according to their castes.                                                                   |
| 25     | 16                             | 12               | Monday.  | Tidhi ends at 4s 16v ) in Nacshatra Uttara Bhadrapada, issues at 42g 43v — Yogù Vaidhriti (27th) ends at 33g 51v — Curna Dhitala (4th) ends at 4g 16v — Thyajum of Wurjum, Devi begins at 3g 55v — Mars commences to be retrograde at 42g — Mercury enters 2d Padah of Nacshatra Criticà (in the Solar Sign Vrisha 8) at 56g — Varaha Jyanti's birth day, (a                   |
| 27     | 17                             | 13               | Tuesday. | Vishcambha (1st) ends 32g 56v-Curna Warnajee (6th) ends 7g 5v-                                                                                                                                                                                                                                                                                                                 |
| 28     | 13                             | 14               | Wednesd. | Yogù Priti (2d) ends at 31g 12v_Curna Soyami, or Shakoni (8th extra-<br>ordinary) ends at 8g 32v_Thyajum of Wurjum, Ratri begins at 7g 4v_                                                                                                                                                                                                                                     |
| 29     | 19                             | Amevasy:         | Thursday | Sun enters 2d Padah of Nacshatra Bharani at 6g Ov—Venus enters 3d Padah of Nacshatra Revati at 33g.  Amavasya, or conjunction, occurs at 8g 47v—) in Nacshatra Bharani issues at 49g 41v—Yogù Ayushmat (3d) ends at 28g 27v—Curna Nagava (10th extraordinary) ends at 8g 47v—Thyajum of Wurjum, Devi begins at 13g 2v—Mercury enters 3d Padah of Nacshatra Criticà at 3g—Sun's |

End of the Lunar month Chaitra.

# FRAGMENTS.

| ` |   |  |  |
|---|---|--|--|
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   | , |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |
|   |   |  |  |

## FRAGMENT I.

On the I'ormulæ of the Hindus for calculating the Eclipses, the Tables of Sines and divers other Astronomical Problems. Extracted from the French Ephemerides (Connoissance des Tems) for the year 1808, and ascribed to Mr Delambre. (Page 447.)

THESE Formulæ will be found in the second volume of the Asiatic Researches. Althor they may have been long since known in Europe, nevertheless as the original Memoirs first printed in Calcutts, and subsequently reprinted in London, are rather scarce, we deem it expedient to announce them to our readers, who, for the most part have never heard of their existence.

Ducham, Bailly, and Le Gentil, have published that the Indians have, for calculating the Eclipses, certain methods which they follow without understanding them.

The author of the Memoir referred to, Mr. Davis, combats victoriously that assertion, by giving in the minutest details, the computation of the Lunar Eclipse of the month of November 1789, which he worked by the Indian Formulæ; his demonstrations and illustrations being grounded on the precepts of the Surriah Siddhanta.

The space which I have at command is too confined to enter into particulars; I shall therefore only state, that I have revised all these calculations with attention, and with the exception of a few points of the Indian doctrines, and of certain suppositions, the proofs of which are not very evident, one may aver that all the rest possesses all the perspiculty which the subject matter requires.

I cannot however, abstain from offering a few words on the Indian Table of Sines, and on the two methods according to which these are calculated; for since the publication of the Memoirs, I have noticed in a note inserted at the foot of the Table, that I had not sufficiently appreciated the merits of the Indian method, because I have been led into a mistake by a constant number which seems to me not to have been exhibited in the Memoir with sufficient clearness.

In the Table under consideration the Sines are expressed in minutes; it proceeds 3° 4 to 3° 4 degrees, supposing the Radius to contain 3133'; or rather 3437',75.—On the same line with the Right Sines, the Table gives the Versed Sines.

If the process prescribed by the Indian author be examined carefully, one perceives easily that his method consists merely in calculating in the first instance a first difference which at the same time is the first Sine of the Table. After which, in order to obtain the second Sine, he calculates the second difference, which he subtracts from the first difference. This process gives the first difference between the first and second Sine; and consequently the second Sine; after which he

calculates another second difference to deduce therefrom a new first difference and a new Sine, and so forth to the end of the Table.

That process is precisely that which I indicated in the preface to the Decimal Tables of Bords, without knowing that this method, which seemed unknown even to the moderns, had been so long practised in India.

My Formulæ is  $\triangle$  (2) Sin A = -4 Sin  $2\frac{\pi}{2}$   $\triangle$  A Sin A = - Chord  $2\frac{\pi}{2}$  A Sin A. See Decimal Table, page 48.

△ being the difference, A the Arc.  $\triangle$  A, being a constant quantity in the Table of Sines, it follows that in order to have the second difference of any Sine whatever, that Sine must be multiplied by a constant number. Now  $\triangle$  A in the Indian Table is 3° 45′, therefore 4 Sin  $2\frac{1}{2}$   $\triangle$  A = 4 Sin 2. 1° 52′ 30′ = 0,00 12321 =  $\frac{1}{223353}$ , from which it results that the constant factor for finding the second difference is  $\frac{1}{23353}$ , that is to say, that the last Sine found must be divided by  $\frac{1}{27353}$ . But according to the Memoir under consideration, that constant divisor, is  $\frac{1}{225}$ , which leads me to suspect that some typographical error has occurred, the more so that the numbers of the Indian author do not agree well with that divisor of 225, whereas with mine  $\frac{1}{23355}$ , and following besides literally the precept, I find (with the exception of a few fractions) the same quantities; as may be seen in the following Table.

| • ,           | Indian<br>Sines.     | Sines by the French Divisor. | 1st<br>Differences. | 2d<br>Differences. |
|---------------|----------------------|------------------------------|---------------------|--------------------|
| 0 0           | 000                  | 000,00                       |                     |                    |
| 3 45          | 225                  | 221,35                       | 224,85              |                    |
| 7 30          | 449                  | 418,75                       | 223,89              | 0,96               |
| 11 15         | 671                  | 670,71                       | 221,97              | 1,92               |
| 15 0          | 890                  | 889,81                       | 219,10              | 2,87               |
| 13 45         | 1105                 | 1105,10                      | 215,29              | 3,81               |
| 22 30         | 1315*                | 1315,56                      | 210,56              | 4,73               |
| 26 15         | 1520*                | 1520,59                      | 204,93              | 5,63               |
| 30 0          | 1719                 | 1719,01                      | 198,42              | 6,51               |
|               | - [                  | !                            | 191,06              | 7,36               |
| 33 45         | 1919                 | 1910,07                      | 182.88              | £,18               |
| 37 30         | 2093                 | 2092,95<br>2266,85           | 173,92              | 8,96               |
| 41 15<br>45 0 | 2267<br>2431         | 2431,08                      | 164,21              | 9,71               |
| 45 0          | 2431                 |                              | -                   | 10,41<br>11,07     |
| 48 45         | <b>2</b> 58 <b>5</b> | 2584,88                      | 153,80              | 11,68              |
| 52 30         | 2723                 | 2727,61                      | 142,73              | 12,24              |
| 56 15         | 2859                 | 2558,66                      | 131,05<br>118,81    | 12,75              |
| 60 0          | 2978*                | 2977,47                      | ,                   | 13,20              |
| 63 45         | 3084                 | 3083,55                      | 106,06              | 13,61              |
| 67 30         | 3177*                | 3176.30                      | 92,86               | 14,94              |
| 71 15         | 3256                 | 3255,54                      | 79,25               | 14,22              |
| 75 0          | 3321                 | 3320,95                      | 65,31               | 14,41              |
| 78 45         | 3372                 | 3372,04                      | 51,09               | 11,60              |
| 82 30         | 3409                 | 3408,59                      | 36,65               | 14,69              |
| 86 15         | 3431                 | 3130,74                      | 22,05               | 14,72              |
| 90 0          | 3438                 | 3438,10                      | 7,36                |                    |
| 93 45         | -                    | ·                            | 7,36                |                    |
| 1 93 45       |                      | 3430,74                      | <u> </u>            |                    |

This Table supposes a Radius greater than 3437,7, and less than 3438,4; according to Archimedes, the Radius would be between 3436,3, and 3438,5; mean 3437,1.

One may perceive that with the exception of some Sines, on which we only differ by a few tenths of a minute, the concordance is perfect in all the Table, whereas with the divisor 225, one would only obtain with approximate exactness the three first Sines, after which the error would increase with rapidity. I suspect that this erroneous divisor, is only a repetition of the divisor 225, which serves for finding the first of the first differences.

The Indian author does not state how he has found his divisor, therefore it can only be verified by the fact. Now the fact demonstrates that he has employed a divisor very little different from mine.

That process is extremely curious: one finds nothing like it in the Trigonometry of Ptolemy, and in order to find some vestige of it, one must, after having vainly poured over all the authors on Trigonometry, come to Briggs, who knew that divisor, which he seems to have found out by the fact, in comparing the second differences obtained by other means; for Briggs himself was not aware that it was the Square of the Chord of the differential Arc  $\triangle$  A.

But one may ask, why the Indians took  $\triangle$  A  $\equiv$  3° 45', instead of 1°. Here I believe follows the answer: it appears to me to have a considerable degree of probability.

There can be no doubt but that the Indians knew the following theorems, Sin 2 A + Cos. 2 A  $\equiv$  Radius 2; Versed Sine A  $\equiv$  Rad.  $\equiv$  Cos. A  $\equiv$  2 Sin  $\frac{21}{2}$  A: whence Sin  $\frac{1}{2}$  A  $\equiv$  $(\frac{1}{2} \text{ Rad.} - \frac{1}{2} \text{ Cos. } \Lambda)^{\frac{1}{2}}$ . Now these three theorems are sufficient for finding all the Sines of their Table, and can give none else-they have therefore achieved all that they could, and their Table shows the limits of their science. Indeed one sees at page 290, that they have really employed these three Formulæ for calculating that Table, and that they knew besides that the Sine of 30' is equal to half the Radius, which seems to leave no doubt on what I have said. Their Table thus constructed, they will have examined the first and second differences; and will have remarked that the first went on decreasing, but they will not have seen at first according to what law? The second differences on the contrary, went on increasing, and it was no difficult matter to discover that they were proportional to the Sines, for the second difference opposite to 30° is 7,36, and that opposite to 90° is 14,72, the double of the preceding one: and to find the ratio of the second difference to the Sine, they will have divided the Radius 3437,75 by 14,72. and found the quotient to be 283,53. Dividing thus every Sine by its second difference, they will constantly have found the same quotient, whence they will have concluded that in order to have the second difference, it suffices to divide the Sine by 233,53.

The Rule for the first differences is not so obvious, for the difference of Sin  $A = 2 \sin \frac{1}{2} A$ , Cos.  $(A + \frac{1}{4} \triangle A)$ , and the Sines  $(A + \frac{1}{2} \triangle A)$  are not in the Table.

But the first of the first differences, is at the same time the first Sine in the Table; from which

they have concluded that with the first Sine, the first of the first and second differences, one had all that was necessary for calculating all the rest. But in truth the Table was already calculated when the Hindu computers gave their differential method, and the proof is, that to make their Table be such as they have given it, they had need to make the first Sine 224,85 and not 225, which would have given the first differences a little too great, and the Sines too small.

It is true that the Surriah Siddhanta directs to divide by 8 the number of minutes which is contained in one Sign, in order to have the first Sine, which comes to the same thing as taking the Sine to be equal to the Arc. Thus  $\frac{30^{\circ}}{8} = \frac{360^{\circ}}{96} = \frac{21600^{\circ}}{96} = 225^{\circ} = 3^{\circ}$  45', whereas the true value found by the three theorems, is only  $224^{\circ}$ ,85. Observe that there is nothing conjectural in all this but the reasoning, which I suppose to be that of the Indian computer, for the Hindus had really all the knowledge which I ascribe to them. I do not pretend either that they used decimal fractions; it is with a view to shorten process that I employed these in reconstructing their Table of Sines, for it is well known that all their calculations are sexagesimal.

They might in taking proportional parts (the use of which was well known to them) extend their Tables to every degree of the circumference, but these interpolated degrees would have had Sines much less accurate, and they have preferred giving those which resulted immediately from their formulæ, and to preserve in all its purity the Table which was to serve for the computation of all the others; but they have given from degree to degree their Tables of Equation of the Center.

Their theory for calculating these Tables of Equations was incomplete and inexact; although they used Epicycles as well as the Greeks for computing the inequalities of the Planets, that Calculus was with them less exact than that of Ptolemy: they had introduced an empyrical Equation ill contrived enough, and they supposed that from 90° to 180° the same Equations returned in an inverse order. In that respect the Greeks were more advanced than the Hindus; their Trigonometry was more perfect, altho' that of the Hindus resembles ours most, and that the Hindus seem to have had some theorems unknown to the Greeks. These Tables of Equations, however defective, present nevertheless a curious consideration; which is, that in the explanation given of them by the Hindus, the differences of the Equations are proportional to the Sine of the Anomaly; or (what comes to the same nearly) that the variation of the Sine is proportional to the Cesine.

It will be found also in that Memoir, that the Hindus found the Latitude of a place by calculating the length of the Shadow of the Gnomon, particularly when the Sun was in the Equator: they might find it also by means, of the Solsticial Shadows on employing the greatest declination, which according to them was 24°.

For determining the Longitudes they observed the Eclipses and compared them to the computations made on the Lunar Tables constructed for their first Meridian.

At page 315 one sees how, by means of their Sines, and without knowing the Tangents, they

computed the Sun's Right Ascension. Also how they computed the Ascensional differences and the point of the Equator which rose with each Sign of the Ecliptic. Their Table for the same was published by Le Gentil, who acknowledges not to understand upon what principles it is constructed; that principle is disclosed in the Memoir and I have commented upon it at full length in a Note.

We shall enter into no discussion on the antiquity of the Surriah Siddhanta (\*). If we were only to consider the form of their Tables, their ideas on the precession of the Equinoxes, their Obliquity of the Ecliptic of 24°, and the theory of the Eclipses, we might suppose the Hindu Astronomical books to be more ancient than those of the Alexandrian Astronomers. On the other hand, finding that they possessed knowledge which is not to be found among the Greeks, one would be tempted to suppose them more modern. All that is common between them is the system of Epicycles for the Planets, but less perfect than that of the Greeks, from which circum. stance one might conjecture that the doctrine of the Indians has passed into Greece, where it was extended and improved. It would be less natural to suppose that the Hindus have received from the Greeks, through the channel of the Arabs, theories which are to be found in their hands but in a crude and incomplete state. All that we can affirm is, that the Memoir under consideration without teaching us any thing that might advance our real knowledge, or serve to the progress of Astronomy, is nevertheless singularly curious for all Astronomers. What renders the reading of it somewhat difficult, is the great number of Hindu technical words preserved in the translation. One might have given a second version where an European idiom alone would have been employed, and I had some thoughts of undertaking it, but to do this with success I had need of some further notions, and researches for which I had no sufficient time.

[Connoissance des Tems, Annee 1808, page 447.



<sup>(\*)</sup> A learned Englishman formerly assigned 3840 years of autiquity to that book from the Epoch when he wrote. Since that time (in A. D. 1799) he has reduced that number of years to 731, i. e. to the year 1268 of our Æra.

## FRAGMENT II.

On certain infinite Series collected in different parts of India, by various Gentlemen, from Native Astronomers.—Communicated by George Hyne, Esq. of the H. C.'s Medical Service.

I have stated in a Note at the foot of page 93 of the Key to the Siddhanta Chandra Mans, (article Hindu Gnomonics) that in Mr. Hyne's opinion the Hindus never invented the Series referring to the Quadrature of the Circle which were found in their possession in various parts of India; and that Mr. Whish, from whom he had obtained some of those which were communicated to the Madras Literary Society, after having first expressed a belief that they were indigenous, had subsequently reasons for thinking them entirely modern, and derived from the Europeans; observing that not one of the Jyautish Sastras who used these Rules, were capable of demonstrating them.

Since the time that I wrote the Note referred to, Mr. Hyne has done me the favour to communicate to me an account of the Series which had come to his knowledge; and I now lay the same before the reader in that Gentleman's own language, being well persuaded that it cannot fail to interest much all the votaries of science.

" My DEAR SIR,

I have much pleasure in communicating the Series, to which I alluded in a former note to you, regarding the quadrature of the circle; and which some have supposed to have been invented by the Hindoos.

Let d be the diameter of a circle, and c its circumference: then the value of c may be obtained by any of the following formulæ.

$$(1) c = 4d - \frac{4d}{3} + \frac{4d}{5} - \frac{4d}{7} - \dots = 4d (1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} - \dots + \frac{1}{2n-1}).$$

$$(2) c = 12\frac{7}{2}d (1 - \frac{1}{3.3} + \frac{1}{5\cdot 3^2} - \frac{1}{7\cdot 3^3} - \dots + \frac{1}{(2n-1)\cdot 3^{n-1}}).$$

$$(3) c = 2d + \frac{4d}{2^2 - 1} - \frac{4d}{4^2 - 1} + \frac{4d}{6^2 - 1} - \dots + 4d (\frac{1}{2} + \frac{1}{1.3} - \frac{1}{3.5} + \dots - \frac{1}{2n-3\cdot 2n-1}).$$

$$(4) c = \frac{6d}{2^2 - 1} + \frac{8d}{6^2 - 1} + \frac{8d}{10^2 - 1} - \dots = 4d (\frac{2}{1.3} + \frac{2}{5\cdot 7} + \frac{2}{9\cdot 11} + \dots - \frac{2}{4n-3\cdot 4n-1}).$$

$$(5) c = 4d - \frac{8d}{4^2 - 1} - \frac{8d}{8^2 - 1} - \frac{8d}{12^2 - 1} - \dots = 4d (1 - \frac{2}{3\cdot 5} - \frac{2}{7\cdot 9} - \dots - \frac{2}{4n-5\cdot 4n-3}).$$

$$(6) c = 3d + \frac{4d}{3^3 - 3} - \frac{4d}{5^3 - 5} + \dots = 4d (\frac{3}{4} + \frac{1}{2\cdot 3\cdot 4} - \frac{1}{4\cdot 5\cdot 6} + \dots - \frac{1}{2n-3\cdot 2n-1\cdot 2n}).$$

$$(7) c = \frac{16d}{1^5 + 4 \cdot 1} - \frac{16d}{3^5 + 4 \cdot 3} + \frac{16d}{5^5 + 4 \cdot 5} - = 4d \left( \frac{4}{5 \cdot 1} - \frac{4}{5 \cdot 1 + 10 \cdot 5^2} + \frac{4}{5 \cdot 1 + 10 \cdot 5^2 + 10 \cdot 17^2} - \cdot \right)$$

$$= \frac{16d}{5} \left( \frac{1}{2} - \frac{1}{\frac{1}{2} + 2^2 + 1}^2 + \cdots + \frac{1}{\frac{1}{2} + 2^2 + 1}^2 + \cdots + \frac{1}{4n - 1^2 + 1}^2 \right).$$

All these series, are very easily derived from that, which expresses the arc of a circle in terms of the radius and the tangent.

Let z be an arc of a circle, of which t is the tangent; r being radius. Then, by the theory of functions, or, by the differential calculus, z = r ( $t - \frac{t^3}{3} + \frac{t^5}{5} - \frac{t^7}{7} + \frac{t}{9} - \cdots$ ). If r = 1 and  $z = 45^\circ$ , then t = 1; and c = 8 z = 4d ( $1 - \frac{t}{3} + \frac{t}{5} - \frac{t^7}{7} + \frac{t}{9} - \cdots$ ), which is the first series. If  $z = 30^\circ$ , then  $t = \frac{1}{3\frac{1}{2}}$ , and c = 12z = 6d ( $\frac{1}{3\frac{1}{2}} - \frac{1}{3 \cdot 3^{\frac{1}{2}}} + \frac{1}{5 \cdot 3^{\frac{1}{2}}} - \cdots$ ) =  $12\frac{1}{2}d$  ( $1 - \frac{1}{3 \cdot 3} + \frac{1}{5 \cdot 3^{\frac{1}{2}}} - \frac{1}{7 \cdot 3^3} - \cdots$ ), which is the second series. If the difference of each pair of terms of the first series be taken successively, then c = 4d ( $1 - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \frac{1}{11} - \cdots$ ) = 4d × ( $\frac{2}{1 \cdot 3} + \frac{2}{5 \cdot 7} + \frac{2}{9 \cdot 11} - \cdots$ ), which is the fourth series: and, if we begin after the first term, then c = 4d ( $1 - \frac{1}{3} - \frac{1}{5} - \frac{1}{7} - \frac{1}{9} - \cdots$ ) = 4d ( $1 - \frac{2}{3 \cdot 5} - \frac{2}{7 \cdot 9} - \frac{2}{11 \cdot 13} - \cdots$ ), which is the fifth series. If the two last series, which are equal to each other, be added together, and each term of the sum be divided by two, then c = 4d ( $1 + \frac{2}{1 \cdot 3} - \frac{2}{3 \cdot 5} + \frac{2}{5 \cdot 7} - \frac{2}{7 \cdot 9} + \cdots$ ) = 4d × ( $\frac{7}{4} + \frac{1}{1 \cdot 3} - \frac{7}{3 \cdot 5} + \frac{1}{5 \cdot 7} - \cdots$ ), which is the third series. If the terms of the following series  $\frac{1}{4} + \frac{1}{2 \cdot 4} + \frac{2}{4 \cdot 6} + \frac{3}{6 \cdot 8} + \frac{4}{5 \cdot 10} - \cdots$  be added and subtracted to and from those of the first, thus:

$$I - \frac{1}{3} + \frac{1}{5} - \frac{1}{7} + \frac{1}{9} - \cdots$$

$$- \frac{1}{4} + \frac{1}{2.4} - \frac{2}{4 \cdot 6} + \frac{3}{6 \cdot 8} - \frac{4}{8.10} - \cdots$$

$$+ \frac{1}{4} - \frac{1}{2.4} + \frac{2}{4 \cdot 6} - \frac{3}{6.8} - \cdots$$

$$\frac{1}{4} + \frac{1}{2 \cdot 3.4} - \frac{1}{4 \cdot 5.6} + \frac{1}{6 \cdot 7 \cdot 8} - \frac{1}{8 \cdot 9 \cdot 10} - \cdots; \text{ then}$$

$$(6) c = 4d \left( \frac{1}{4} + \frac{1}{2 \cdot 3 \cdot 4} - \frac{1}{4 \cdot 5 \cdot 6} + \frac{1}{6 \cdot 7 \cdot 8} - \cdots \right).$$

(7) If the terms of the series  $\frac{1}{5}$ ,  $\frac{2}{17}$ ,  $\frac{3}{37}$ ,  $\frac{4}{65}$ ,  $\frac{5}{101}$  - -  $\frac{n}{4n^2+1}$  be added and subtracted to and from different terms of the series  $1 - \frac{1}{3} + \frac{1}{6} - \frac{1}{7}$  thus:

$$1 - \frac{1}{3} + \frac{1}{3} - \frac{1}{7} + \frac{1}{9} - \cdots + \frac{1}{2n-1}$$

$$- \frac{1}{3} + \frac{2}{17} - \frac{3}{37} + \frac{4}{65} - \frac{5}{101} - \cdots + \frac{n}{4n^2 + 1}$$

$$+ \frac{1}{3} - \frac{2}{17} + \frac{3}{37} - \frac{4}{65} - \cdots + \frac{n-1}{4n-1} + \frac{1}{2n-1}$$

$$\frac{4}{5} - \frac{4}{255} + \frac{4}{3145} - \frac{4}{16835} + \frac{4}{9^5 + 4^{*}9} - \cdots + \frac{4}{2n-1} + \frac{4}{9^5 + 4^{*}9} - \cdots$$
then  $c = 4d$   $\frac{4}{(1^5 + 4^{*}1} - \frac{4}{3^5 + 4^{*}3} + \frac{4}{5^5 + 4^{*}5} - \frac{4}{7^5 + 4^{*}7} + \frac{4}{9^5 + 4^{*}9} - \cdots$ 

$$+ \frac{4}{2n-11^5 + 4 \cdot 2n-1}), \text{ which is the seventh formulæ.}$$

I am, my dear Sir, most sincerely, your's,

Madras, 17th August 1825.

## FRAGMENT III.

On the Tanul Divisor of 576 years. Text, page S.

INDEPENDENTLY of what has been said in the Text and Commentary of the Divisor 576, I shall remark one of its peculiarities which has hitherto escaped attention.

It is sometimes convenient in the course of investigation, and particularly in cases where the juxta position of Epochs is required, to set off on one side from a Root free from fractions. Now the period of 576 years enables us to resolve the Problem with great ease, provided an Epoch whose Root is an integer, be given.

For if out of Table I, we take the abstract Root for 576 years (\*) we will find it to be (4\*) O' O' O', and as there are seven days in the week, on each of which the Saura Mana may begin, if we multiply 576 by 7, we have 4032 years for product, whose abstract Root by Table I is (0\*) O' O' O'. (†)

#### EXAMPLE.

Let the initial Root of A. C. 3330 current, or 3329 complete, be resolved, it will be, 3329-3102-A. D. 227.

|                                                  |                 | D.  | G. | ٧. | P. |
|--------------------------------------------------|-----------------|-----|----|----|----|
| Epoch A. D. 200, Table IX,                       | 200             | (1) | 0  | 50 | 15 |
|                                                  | 20              | (4) | 10 | 25 | 0  |
|                                                  | 7               | (1) | 48 | 38 | 45 |
| Initial Root A. C. 3330 complete                 | 227             | (0) | 0  | 0  | 0  |
| Hence if to the Epoch A. C. 3329                 |                 | (0) | O  | 0  | 0  |
| We add (or subtract) abstract Root for 576 years | +               | (4) | 0. | 0  | 0  |
| We have                                          | Sum             | (4) | 0  | 0  | 0  |
| Dif                                              | ferenc <b>e</b> | (3) | 0  | 0  | 0  |

But if instead of the abstract Root for 576 years we use that of its multiple 4032 years, viz. (0°) 0° 0° 0° 0°; it is manifest that the Epoch will remain as it was, relatively to the initial feria.

| (*) For the abstract Root for 576 years, Table I                        | 50 <del>0</del><br>70<br>6 | (6)<br>(4)<br>(0) | 20<br>6<br>33  |               | 9<br>30<br>30 |
|-------------------------------------------------------------------------|----------------------------|-------------------|----------------|---------------|---------------|
| Abetract Root                                                           | 576                        | (4)               | 0              | 0             | 0             |
| (†) For the abstract Root of the period of 4032 years we have, Table I, | - 1000                     | (5)               | 40             | 50<br>×       | 0             |
|                                                                         | 4000<br>30<br>2            | (1)<br>(2)<br>(1) | 43<br>45<br>31 | 20<br>37<br>2 | 0<br>30<br>30 |
| Abstract Root                                                           | 4032                       | (0)               | 0              | 0             | •             |

In the same manner, if there be any fraction in the proposed initial Root, or Epoch, the fraction in both cases will remain unaltered.

On this principle I have calculated the initial Roots of the following years, which exhibit every possible change which may occur where the generating Root or Epoch consists of integers only.

Generally, in the period of 4032 years the series of initial integer Roots in ascending progress will be 0, 3, 6, 2, 5, 1, 4, 0, &c. and in descending years 0, 4, 1, 5, 2, 6, 3, 0, &c.

This, however, is not to be mistaken for a Solar Cycle, excepting as far as the feriæ which begin the Solar years are concerned.

| Years<br>Saca<br>complete  | Years<br>Caliyugam<br>complete     | Years<br>Ante<br>Christum,              | Roots<br>of<br>Initial<br>Feriæ. |
|----------------------------|------------------------------------|-----------------------------------------|----------------------------------|
|                            | 449                                | 3804<br>3228<br>265 <b>2</b> 0          | 0<br>4<br>1                      |
|                            | 1025                               | 2076                                    | 5                                |
|                            | 1603                               | 1500                                    | 2                                |
|                            | 2177                               | 924                                     | 6                                |
|                            | 2753                               | 348                                     | 3                                |
| 150<br>726<br>1302<br>1878 | An<br>3329<br>3905<br>4481<br>5057 | no Domini<br>228<br>840<br>1380<br>1956 | 0<br>4<br>1<br>5                 |
| 2154                       | 5633                               | 2532                                    | 2                                |
| 3030                       | 6209                               | 3108                                    | 6                                |
| 3606                       | 6785                               | 3684                                    | 3                                |
| 4182                       | 7361                               | 4260                                    | 0                                |
| 4758                       | 7937                               | 4836                                    | 4                                |
| 5334                       | 8513                               | 5412                                    | 1                                |
| 5910                       | 9089                               | 5988                                    | 5                                |



## FRAGMENT IV.

Computation of an Eclipse of the Moon by means of certain memorial and artificial words, and of shells in lieu of figures; the formulæ for which refer to the four Vakiam Tables (the XXVIth, XXVIIth, XXVIIIth and XLVIIth) published in this collection.—By Sami Naden Sashia, a Kalendar maker residing in Pondicherry.

Almanae makers computed Eclipses; scoring their quantities with shells, instead of writing them in figures; and dispensing with the use of Tables, by means of certain artificial words, and syllables; which recalled the required numbers and Equations to their recollection, and was long desirous to obtain a positive proof of the truth of that report, which I always suspected to be much exaggerated. After a long search for one of these mechanical computers, a person was introduced to me by my venerable friend Abbe Mottet (one of the Missionaries of the Institution de Propaganda Fide in this part of India), and I found the Sashia thus introduced to me, competent to my object, for (as I wished) he did not understand a word of the theories of Hindu Astronomy, but was endowed with a retentive memory, which enabled him to arrange very distinctly his operations in his mind, and on the ground.

This person, whose name was Sami Naden Sashia, computed before me the Lunar Eclipse which forms the subject of the present Fragment; and after a due examination of his process, I concluded (as indeed I had expected) that the artificial words which were supposed to elicit results, were only designed as vehicles for finding the arguments of the four Vakiam Tables published in this collection, and of some others not included therein, without which it would have been impossible for him to perform his task.

With regard to his calculating with shells and counters, (the latter representing zeros) it amounts to nothing more than scoring any number of points when playing at cards with similar articles, but on a larger scale. The multiplication and division of numbers, these computers abridge by means of particular Tables, generally constructed by themselves, which contain the number of multiples of the Elements which are likely to be wanted in the operation; so that in the first case, they find the product at once; and in the second, by help of the nearest quantity to the dividends they find the quotients in the adjoining columns, the operations being thus reduced to addition and subtraction.

The foregoing explanation may I believe, dispense me from representing all the figures resulting from the various dispositions of the shells in the different branches of the Problem, and admit of

my using figures in the more complicated part of this computation; this being necessary to avoid confusion in explaining the process; for there is no cancelling on paper, a rule which they cause to vanish by mixing the shells the instant that its results have been obtained; preserving only the latter for future application in a distant part of the ground on which they operate.

Numerical account of the Sounds.

- 1 Ka; Tha; Pah; Ya or Yum; Kiah; wia; Staha; nuium.
- 2 Kha; Thaha; Paha; Rra; Kra; Ra; Ri.
- 3 Gheu; Dheu; Bheu; la; Kla.
- 4 Gaha; Dhaha; Baha; Va; Ve; Kooa.
- 5 Ghank; Nanh; Ma or Mun; Na; Sa.
- 6 Tsha; Ta; Tou; Shah; Utsha; Cshe; Recshe.
- 7 Tshaha; Taha; Saha; Za.
- 8 Dja : Deheu ; ha ; hi ; Dheua ; Do.
- 9 Djiha; Dhaha; Lhah; Dha.
- O Guia. Na. Ni. Rno. a. (the last, or zero, being always expressed with a counter.)

A near approximation to all these sounds is considered as included in the list, and therefore renders their articulation very numerous.

This variety of sounds for the same number was invented for the purpose of avoiding cacophony, when using them to express large quantities, wherein the same figure may be repeated several times; and also to give to the collected syllables the resemblance of a rational word.

When a regular technical term is too short to be split into as many syllables as the quantity which it expresses contains of digits, then they lengthen it at pleasure and construct by that means, a memorial word which answers their purposes. This will be exemplified in the following exposition of the Elements of the Vakiam process.

```
The Vedam, Veda—Gnia—na—tou—Staha.
```

The Raza Gherica, Ru\_za\_Gheu\_ri\_ca.

The Kalanilam, Ka\_la\_ni\_la.

The Devaram, Dheu\_va\_ra.

These syllables they expound by inverting their arrangement, beginning with the last, and ending with the first; and scoring from the right, thus:

Staha • \_\_tou :: \_ Na O \_ Gnia O \_ Dha ::: - Do :: \_ Ve : a
Vedam, or 1000984 days.

· In ••• - Ni O - la ••• - Ka • a Kalanila or 3031 days.

Rra .. \_ Va : \_ Deheu : . . a Devaiam or 218 days.

As for the Chandra Vakiam Dhurmavana, because it varies on each day of a Devaram, the computer retains that Element numerically in his mind; and the three digits which it contains (and can never exceed) recal to his recollection one of the 248 artificial words, which he learnt by heart; the sounds of each of which indicates the Moon's Equation due to the Druva of the day computed for. Thus, as will appear presently, the Chandra Vakiam on the 20th Vyassei (Bengal Jyaishtá) being 129, the computer says unto himself, Di—wia—va—Ra—Dja, which inverting he finds in his memory,

Dja .... Ra ... Va ... wia ... Di ... which indicates 8° 24° 18'.

If it had been for a Vakiam of 101, it would be, Dja \_\_no\_ma\_nnium\_hi ., and by inversion hi ... \_\_ nnium ... ma ... no O... Dja ... which gives 8° 15° 8', vide Table XXVI.

#### For the Ahargana and Soota dina.

We need not repeat here what was so fully explained in the body of this work on the sulject of these Elements. As the Almanac makers make their computations periodically, the Ahargana of the preceding year, furnishes them the means of finding that of the Sun for the beginning of the succeeding one, which is done by adding 365° 15° 31° 15° thereto. And the absolute duration of each Solar month, such as given in Table III of this collection, (which they all know by heart) enables them to find that for any particular day in the year, without any formal computation.

As for the recurrence of the new Moons, most of them use a Cycle of 19 years, like that of Meton; and with regard to the Eclipses (both Solar and Lunar) I believe many of them have learnt from the Europeans the use of the Chaldaic period of 223 Lunar months, or 18 years and 10 days; and that they venture to compute on a probability that they will hit on the proper day. I suppose that their knowledge of that period is of foreign origin; for I see it mentioned no where in their Astronomy. Certain it is however, that the common Tamul Kalendar makers, do not trouble themselves about the Luni-solar Ahargana, and that in their computations of Eclipses, every thing rests on the Solar one. (\*)

#### ARTICLE 1.

The computer having established that a Lunar Eclipse is likely to occur on the 20th day of the Solar month Vyassei (Bengal Jyaishtá) of the Chacra year Parthiva, being the 4926th of the Cali yug, and the 1747th since the birth of Salivahana, calculates his Ahargana as above described, and finds it to be 1799313' 2' 18' 15', which he expresses thus, with his shells.

Vide Table III of this collection.

<sup>(\*)</sup> Sami Naden acknowledged to me, that he had learnt how to determine when an Eclipse was possible, from Christian Missionaries: but that there was nothing about it in his books.

and dividing the sum of days by 7, he finds that the last expired day fell on Tuesday, and the current one on Wednesday; because altho' they count the remainder after division from Friday as zero, for the beginning of the years and months, they reckon Friday as 1, for the intermediate days of the month.

If we want to find the European date of these, Tuesday and Wednesday, we may have recourse to the methods which were disclosed in the first part of the Key to the Madhyama Saura mana: and Tuesday will be found to fall on the 31st of May (20th), and Wednesday on the 1st of Jane 1325, (21st Vyassei).

#### ARTICLE 2.

### For the Sun's opporent place.

The next step to be taken is, to compute the Sun's apparent place at his rising on the Sunta dina, which was explained at full length at page 124 and following, (Key to the Siddhanta Chandra mana, Pirt II), and therefore need not be repeated here. I shall only give the abstract of the Rule, as follows:

10 The Zhargana for the 20th Vyassei, (besides the sum of days) gave a fraction of

which guddias, viguddias, &c. are to be added as culas, viculus, &c. to the Sun's Saura degrees. (\*).

To proceed.

## For the Sun's Saura place.

20 On the 20th Vyassei the Sun had moved through one complete

Sign (that of Mesha)

Take for 19 complete days

, 57 guddies

, 41 viguddies

, 41 viguddies

, 45 paras

Sun's Saura place at Sun-rise

1 19 57 41 45

30 To equate which, we have by the Yoghiadi Table (XXVII) for the first 8 days in V) issei

Do. 2' or 13 days

And for 4 days that remain (\frac{1}{2} \text{ of 22}) - \frac{11}{5um 51}

<sup>(\*)</sup> Vide Note at the foot of Table XXVII, part L. But then here we are to take 19°, and not 20°, for the 20th of Vyasse,; otherwise we would have to subtract 2' 15".

But we want for  $2^c$  13' 15° less (page 337); therefore as we have  $22^c$  for 8 days, it is  $\frac{23}{5} \pm 2^c$  45' for 1 day, and  $60^c$ :  $2^c$  45' ::  $2^c$  13' 15 :  $6^c$  20°, which retrenching from 51' give the Equation sought 50' 53' 40' subtractive.  $\bigcirc$ 's Saura place - 1' 19° 57' 41' 45'

ARTICLE 3.

For the Moon's apparent place.

10 We are first to compute the Moon's Drava; which is performed as indicated at page 132 and 133 of the second Memoir; it being remembered that the common Kalendar makers perform their divisions and multiplications, by the help of Tables of multiples as stated at page 334 of this article; and the result in the present instance is 1 vedam; 16 raza ghericus; 0 calanilum, and 1 devaram, with a remainder of 129, being the Chandra Fakiam Dhurmavanham.—The four Elements they multiply into the respective Longitudes, as shewn at page 133, the products being as follows:

| 1 vedam         | -      | -               | - | 7' | 2' | 0' | 7# |
|-----------------|--------|-----------------|---|----|----|----|----|
| 16 raza gherica | .s     | •               | - | 2  | 24 | 50 | 40 |
| No calanilam    |        |                 | - | 0  | 0  | 0  | 0  |
| 1 devaram       | -      | -               | - | 0  | 27 | 41 | 6  |
|                 | Chandr | a Dru <b>va</b> | - | 10 | 21 | 31 | 53 |

which is to be equated by means of that operation which they call Phula Trium Desentara, (vide page 134, and Table XLVII.)

20 It will have been found that after having divided the Ahargana by the four Elements, there was a remainder of 120 days, which is the Argument of Table XXVI. Now these figures recal to the memory of the computer, the following artificial syllables.

Di-wia-va -ra-dja, -which being reversed and expounded

produce S' 21' 1S', which is the first part of the Equation required.

39 For the Equation of the Desentura calas, we are to refer to Table XLVII, and find that those due to the preceding month, Chaitram (Bengal Vaisúcha) are 15', always additive. And for the Andra vicalus, the same Table gives us for Vyassei, itself — 10".

which, (as was explained at page 134), are to be subtracted from the Desentura calus, being the second Equation sought:

40 Lastly, for the Madhya Gati vicalus, we are to resort to the Chandra Vakiam, 'or Argument of Table XXVI) 129. Referring to the said Table we find the Moon's Sputa Gati, or true motion, for that number of days

- 826 calas

and as for each devaram (248 days) elicited by the division of the Ahargana by the four Elements, there is an Equation of 32 tarparies or thirds, and as in the present case there was only one devaram in the results (page 337), we have  $35\times32^n\equiv1120$  tarparies  $\equiv18v$  40°; and on account of 40° say 19 vicalas, which is the third Equation required.

50 With these results we come to the following conclusion.

| Moon's Druva       | -           | •        |        | -     | • | 1            | 0 | 2 l° | 34′ | 5 <b>3</b> " |
|--------------------|-------------|----------|--------|-------|---|--------------|---|------|-----|--------------|
| Chandra Phala      | -           | •        |        | -     |   | -            | 8 | 21   | 18  | 0            |
|                    | Moon's app  | roximat  | e Long | itude | • |              | 7 | 18   | 52  | 53           |
| Desentara calas (p | 1ge 338)    | - 15'    | O.     |       |   |              |   |      |     |              |
| Andra vicalas (pag | ge 338) 🖫   | 3        | 11     |       |   |              |   |      |     |              |
|                    | Equation .  | - 11     | 49     | -     |   | •            |   | +    | 11  | 49           |
| Madhya Gati vica   | las         | -        | -      | -     |   | -            |   | +    |     | 19           |
| Chandra            | a Sputa Gra | ha, 20th | Vyas   | sei   | - |              | 7 | 19   | 5   | 1            |
|                    |             |          |        |       |   | <del>-</del> |   |      |     |              |

It is always to be understood that all these additions and subtractions are performed by the play of shells, which is very expeditious, but would have become tiresome if represented every time on paper.

## ARTICLE 4.

#### For the Argument of the Purnima Tidhi.

This article is for finding the instant of opposition, which is always the end of the 15th Tidhi in the Lunar month. The operation consists in taking the difference of the Sun and Moon's Longitude, and then by the method indicated at page 137, to find the instant when it occurs after that of true Sun rising, on the particular day referred to, for which last article see also page 106.

These respective Elements the mechanical computer disposes, with his shells, in the following order.

| Dis     | tance.  | "s Longitude. | O's Longitude. |
|---------|---------|---------------|----------------|
|         | •••     | •••           | •              |
| ••      | ••••    | • • • • •     |                |
| •••     | ::::    | • • • •       | *              |
| •       | • • •   | •             | :: ::::        |
| 5s. 29° | 58' 13' | 7 19 5 1      | 1s. 19° 6′ 48″ |

and proceeding as above stated, he finds that the instant of opposition occurred on the 21st Vyassel, at 07 307 CP after true Sun rising at the place computed for.

It is not however, to be believed that the common Almanac makers calculate the true duration of the artificial day and night in the manner that was explained in the second section of the 8th article of the Key to the Siddhanta Chandra mana, the problems of which are far beyond their comprehension. They have a Table where the time of the Sun rising and setting for every day in the year, is ready computed; which serves them for a great number of years, and to which they refer the end of each Tidhi. When unable to construct it themselves, they procure one from their more harmed colleagues.

#### ARTICLE 5.

For the apparent place of the Moon's Node, called Rahu.

Of the theory of this part of the Problem I could not obtain even the most general account; and circumstances of a painful nature, have prevented me from investigating it as I intended to have done. I give therefore the computation as I received it, with a belief however, that with the assistance of the data contained in this work, there will be no difficulty to demonstrate its several propositions.

10 The Tanul Almanac makers use a constant number, recalled to their memory by the sounds Cshe—thi—na—Gnii—Ruo—Recshe—yam, which inverted as usual gives

2º They next put down this remainder in two places,

30 This product is to be divided by another constant number recalled by,

<sup>(\*)</sup> The daily motion of the Moon's Nude being 3' 16" 45" 6"" 50"" or 3' 16" 45",1446 &c. if we suppose it to be in any point of the Eel ptic at the beginning of a period of 1600006 days, it will be precisely 6 Signs behind it, at the call of the same.

169809) 1793223 (10 days

### 40 Proceeding to the said division, we have

169309 95133  $\times 60$ ) 5707980 (33 guddias The quotient 10d 33t 36v 50v they put down 509127 613710 under the shells which marked the first time 509 127 104283 199247 \* (page 340), and subtracting it from × 60 the same, they find a remainder of 199236d ) 6256980 (36 viguddias 509427 26: 23' 10º (vide supra). 1162710 1018854 143356 X 60 ) 8631360 (50 paras 8490450 140810 &c.

and this remainder they again divide by a number, recalled by the sounds, Cshe\_tha\_mum;
which answers to

Mum\_tha\_Cshe

In order not to confuse his shells, the computer performs that division in two or three steps, so as to bring out round numbers, as much as he can; thus

Divide again the degrees by 566) 34093 (60 = 2 signs, which add to 250 above found.

93 which neglect.

Hence we have a quotient of 352' 0° 14' 7" of which retrenching the complete revolutions,

| we have  | -         |         |          | 4    | 5 <b>0°</b> | 14 | - 71       |
|----------|-----------|---------|----------|------|-------------|----|------------|
| From 12  | signs     | -       | •        | 12   |             |    |            |
|          | Supplem   |         | -        | 7    | 29          | 45 | 5 <b>3</b> |
| And add  | a Bijah   | ef (*   | ) -      | -    |             | 40 | 0          |
| Scota Ra | thu, or t | rze pla | ace of § | ι, s | 0           | 25 | 53         |

#### ARTICLE 6.

For the Patum Chandra Puram, or Argument of the Moon's Latitude.

1º Retrench Rahu's place from the Moon's, increased by 12 signs.

| Moon's Sputa Graha, (page 339)                     | 7'<br>12 | 19°     | 5′      | 1"      |
|----------------------------------------------------|----------|---------|---------|---------|
| Soota Rahu & =                                     | 19       | 19<br>0 | 5<br>25 | 1<br>53 |
| Take the Bhujah (page 86)                          | 11<br>12 | 18      | 39      | 8       |
| Argument of Vicshipa calas, or minutes of Latitude | - 0      | 11      | 20      | 52      |

Table of Vieshipa Pataca cala.

2º With 11° refer to the Vicshipa Pataca cala Table here annexed, you find

| •                              |   | 1  | W  |
|--------------------------------|---|----|----|
| For 11 -                       | _ | 51 | 32 |
| Proportional parts for 20' 52" | - | 1  | 37 |
| Nija Vicshipa calas            | - | 53 | 9  |
| which keep in reserve.         |   |    |    |

| I attica cara. |            |             |  |  |  |  |  |
|----------------|------------|-------------|--|--|--|--|--|
| •              | · '        | 7           |  |  |  |  |  |
| 1              | 4          | 43          |  |  |  |  |  |
| 2              | 9          | <b>2</b> 6  |  |  |  |  |  |
| 3              | 14         | 8           |  |  |  |  |  |
| 4              | 18         | 51          |  |  |  |  |  |
| 5              | 23         | 32          |  |  |  |  |  |
| 6              | 28         | 14          |  |  |  |  |  |
| 7              | 32         | 55          |  |  |  |  |  |
| 8              | 37         | 40          |  |  |  |  |  |
| 9              | 42         | 19          |  |  |  |  |  |
| 10             | 46         | 53          |  |  |  |  |  |
| 11             | 51         | 32          |  |  |  |  |  |
| 12             | 5 <b>6</b> | 8           |  |  |  |  |  |
| 13             | 60         | 43          |  |  |  |  |  |
| 14             | 65         | 19          |  |  |  |  |  |
| 15             | 69         | 54          |  |  |  |  |  |
|                |            | <del></del> |  |  |  |  |  |

#### ARTICLE 7.

For the Chandra Mandala Libitangula.

The Chandra Vakiam Dhurmavanham, which was found to be 129 days (page 338), when referred to Table XXVI, shewed that the Moon's true motion on the said devaram day was 826'.

| 1º Divide the same by     | •       | -     | ~    | ~     | <b>-</b> ' | • | - | 25)8 <b>2</b> 6′(3 <b>3′ 2*</b><br>75 |
|---------------------------|---------|-------|------|-------|------------|---|---|---------------------------------------|
|                           |         |       |      |       |            |   |   | 76                                    |
|                           |         |       |      |       |            |   |   | <b>7</b> 5                            |
|                           |         |       |      |       |            |   |   | 1                                     |
|                           |         |       |      |       |            |   |   | 60                                    |
| The quotient 33' 2" is ca | alled C | landr | a Ma | ndala | Libita     | · |   | 25)60(2                               |
|                           |         |       |      |       |            |   |   | 50                                    |
|                           |         |       |      |       |            |   |   | 10 which neglect.                     |

<sup>(\*)</sup> The addition of these 40 calas in all computations of the place of the Moon's Node, by the Kalendar makers, appears to me manifestly empyrical.

0

40

49

αa

Put down this quotient in two places,

Grahana Libita, (Difference) which lay by - 4 391

(N. B.—Here we have two sides of a right angled triangle, viz. the Mana Yogarda

Libita,

And the Nija Vicshipa Cala

which keep in reserve.)

#### ARTICLE 8.

For the Csh'shna, or quantity of the Disk eclipsed.

Having found the difference of the above two Elements to be  $4' \ 30\frac{1}{2}''$ ; or say  $4' \ 40''$ , we are to divide the same by the *Chandra Mandala Libita*,  $33' \ 2'' (1982'')$  found at page 342, for which purpose we are to raise that quantity by repeated multiplications into 60, until the latter may divide the former.  $4' \times 60 + 40'' = 280''$  and  $280'' \times 60 = 16800''$ 

1982) 16800" (8,47 &c. 15856 9440 which neglect 7928 &c.

and the quotient is the Csh'shna, shewing that 8-60ths of the Moon's Disk will be eclipsed.

#### ARTICLE 9.

For the middle, beginning and end of the Eclipse.

1º Square the Mana Yogarda Libita, 57' 49" (Tamul process).

49

57

10

57

57

399 285 3249

| 31                                           | 49           | 49                          |
|----------------------------------------------|--------------|-----------------------------|
| 313                                          | 513          | 441                         |
| <b>2</b> 45                                  | 228          | 196                         |
| 2793                                         | 2793         | 2401                        |
| Divide the 4th product by                    | 60) 2401 (40 |                             |
| Add the quotient to the 3d                   | ~            | 2793<br>40                  |
| Add the 3d 2                                 | 2 2          | <b>2</b> 833 <b>2</b> 793   |
| Divide by                                    |              | 60) 5626 (93,46<br>226      |
| Add the quotient to the 1st                  | <u> </u>     | 46<br><b>32</b> 19<br>93 46 |
| Mana Yogarda Vurga<br>the square of 57' 49". | , Ē          | 3312 46                     |

57

40

2º Square the Nija Vicshipa Cala 53' 9".

Divide the 4th by 60) \$1 (1 21 which neglect

Add the quotient to the 2d.

3º For the Mools Yurga, or squere of the third side of the triangle.

4º Find the square root of the Moola Vurga, (Tamul process.)

| Dispose the figures with shells thus Say 2×2=4 | Single. 5 — 4 | (*) 4<br>(‡) 4<br>Double.<br>1 | (†) 4<br>(*) 6<br>Single.<br>7 | Of 117 that remain divide 100 by 40 (because 4 * is placed in the column |
|------------------------------------------------|---------------|--------------------------------|--------------------------------|--------------------------------------------------------------------------|
| Place the product under                        | -             |                                | _                              | of tenths).                                                              |
| 5, and over 1 (*) subtract                     | 1             | 1                              | 7                              | 40)100(2×40= <b>E0</b>                                                   |
| the latter.                                    |               |                                |                                | 20                                                                       |
| (x) Flace the quotient 80 ?                    | •             |                                |                                | Add 17                                                                   |
| after division of 100 under                    |               | 8                              | 0                              |                                                                          |
| 117, and subtract                              |               |                                |                                | Sum 37 (x)                                                               |
| ,                                              |               | 3                              | 7                              | Say again 2×2= (+) 4                                                     |
|                                                | .8            | ubtract                        | <b></b> . 4                    | which place at top in the                                                |
|                                                |               |                                |                                | column above 7, and under                                                |
|                                                |               | 3                              | 3                              | 7 helow, from which sub-                                                 |

Multiply the remainder 33 by 60; and add to the product the 51 odd vicalas, i. e. 33×60+51 =2031", which divide by 44 expressed at the top of the Rule (\* and †).

44)2031(40 1760 Stop here - 271

<sup>(\*)</sup> The lat square by the European rule is 3342° 46′ 1″, the 2d 2824° 55′ 21″, and the square root of the 3d is 22′ 44″ 11″, the difference proceeding from the Hindu rule neglecting the last fractions.

For the quotient 40 place 4 (‡) in the column at top between (\*) 4 and 1.—Square the last quotient 40×40=1600, which divide by 60)1000(26' 40", and because the fraction 40 exceeds 40 (the half of the divisor 44) take 27.

and because the remainder exceeds 22, take 6 (\*), which quotient place at top in the column between (†) 4 and 7.

Lastly, take the half of 44 (\* and †) which amounts to 22, then the Moola Vurga Meta, or the square root of the curtate distance, or Mana Yogarda Libita (page 343) is 22 calas, 46 vicalas, which lay by (vide note page 311.)

#### ARTICLE 10.

For the Grahama Tincomia Padhi, or half the duration of the Eclipse.

We have already seen (page 342) that the Moon's true motion for 129 days

Now as we are to divide the Moola Varga Meta 22' 46", by the Sun and Moon's relative motion, raise it by repeated multiplication into 60, so that it may be divided by the latter, that is  $22 \times 60 + 46 \times 60 = 81939$ .

and the quotient is the half duration of the Eclipse, viz. 15 467 369.

<sup>(\*)</sup> The Sun's true motion on the 20th Vyassei, by Table XXVIII, is 57' 11".

#### ARTICLE 11.

For assigning the time of middle, beginning and end of the Eclipse.

It was stated at page 340, that the Purnima Tidhi ended on the 21st of Vyassei at 0 30

| after true time of Sun rising. Now by the Tables which give the dur   | ration of t | he a <b>r</b> ti | ficial days |
|-----------------------------------------------------------------------|-------------|------------------|-------------|
| and nights for every day in the year, it appears that the duration of | the day is  | -                | 31 35'      |
| 20th to 21st Vyassei. Of                                              | the night   | -                | 23 25       |
| 285 25' mark therefore the true instant after Sun setting when        | he rises    | again.           | But the     |
| Purnima Tidhi ended (the instant of opposition, page 340) at          | 0, 30       | * afte           | r 💿 rise.   |
| Let it therefore be added to                                          | 28 25       |                  | 4           |
| End of Tidhi from preceding Sun set .                                 | 28 55       | after            | ⊙ set.      |
| End of Tidhi 2                                                        | 8° 55' (    | Э»               |             |
| From which retrench Grahana Tinooria Padhi (page 345)                 | 1 46 3      | 6                |             |
| <u> </u>                                                              | 7 8 2       | 4                |             |
| Beginning of Eclipse on the 20th Vyassel after Sun set 27" 8" 24"     | after Sun s | et the           | preceding   |
| evening.                                                              | ø,          | v.               | P.          |
| To the time of beginning                                              | 2           | 7 8              | 21          |

To the time of beginning 27 8 24

Add 2 × 1g 46v 36p - 3 33 12

But the Sun rose on the 21st at 28 25 0

2 16 36

therefore the time of end of Eclipse on the 21st after Sun rise is, 25 16v 36p.

#### Conclusion.

Hence the Phases, or Calus, of the Eclipse under consideration, are as follows:

Beginning 20th Vyassei after Sun set. Middle 21st do. 30 0 after Sun rise. End do. do. 16 36 after do, Digits eclipsed 8-60ths of the Moon's Disk.

#### ARTICLE 12.

The Phases of the Eclipse as computed by the Tamul Formulæ, compared to the same calculated for the Meridian at Madras according to the European method.

We have seen (present page) that the duration of the night from the 20th to the 21st Vyassei, answering to that of the 31st May and 1st June 1825,

|         |                |    |          | Indiar | ı time.            | European time,      | • |
|---------|----------------|----|----------|--------|--------------------|---------------------|---|
| was     | -              |    | <b>~</b> | 28g    | 25₹                | 11 <sup>h</sup> 22' |   |
| The hal | lf of which is | -: | *        | 14     | $12\frac{\tau}{2}$ | 5 41                |   |

which indicates that according to the Hindu account, the Sun rises on the 21st Vyassei at 5 41' A. M. (\*)

|                                     |               |         |          | G. | v. | P. | n. | ,  | ,  | R  |
|-------------------------------------|---------------|---------|----------|----|----|----|----|----|----|----|
| To the time of Sun rising           | •             | •       | -        | 14 | 12 | 30 | 5  | 41 |    |    |
| Add that wanting from the en        | nd of Purnima | Tidhi ( | page 340 | )) | 30 | 0  |    | 12 |    |    |
|                                     | Middle of I   | Eclipse | -        | 14 | 42 | 30 | 5  | 53 | 0  | 0  |
| Add and sub. \frac{1}{2} duration ( | page 346) 干   |         | •        | 1  | 46 | 36 |    | 42 | 38 | 24 |
|                                     | Beginning of  | do.     | -        | 12 | 55 | 54 | 5  | 10 | 21 | 36 |
|                                     | End of do.    |         |          | 16 | 29 | 6  | 6  | 35 | 33 | 24 |

which furnishes the following comparison.

|           |   | Europeau. |     | Tai | ուս1. | Difference. |  |  |
|-----------|---|-----------|-----|-----|-------|-------------|--|--|
|           |   | п,        | •   | н.  | 1     |             |  |  |
| Beginning | - | 5         | 15  | 5   | 10,35 | 4',25       |  |  |
| Middle    | • | 5         | 30  | 5   | 53,00 | 23,00       |  |  |
| End       | • | 5         | 44  | 6   | 35,63 | 51,63       |  |  |
| Digits .  | - | 12'       | 30" | 8′  | 23"   | 4' 2"       |  |  |

#### OBSERVATION.

When it is considered how very coarse and undefined as to the place for which the Eclipse is computed, the process used by the Tamul mechanical computers undeubtedly is, it is really surprising that these results should come no wider from the truth. It is not however, to be believed that they are always equally successful in their predictions, and that the people who are bound to religious observances when these phoenomena recur, are never disappointed in their expectations. I recollect a circumstance which occurred not many years ago, when an Eclipse of the Moon had been announced for a certain evening in the Madras Panchangum; in consequence of which crowds of people had resorted to the Beach for performing their ablutions; but no Eclipse appeared; a circumstance which in China might have endangered the mistaken Astronomer's life, but with the gentle Indian, only occasioned a good deal of noise; and with a few, some merriment on his ill proficiency. The case I refer to may have proceeded from the ignorance of the Sastra; but it is certain (and will be readily believed) that even where the most skilful Astronomer is employed, no reliance can be placed on those raw predictions which are never certain within several hours of the time when an Eclipse is to occur.

It was originally my intention to have added an example of a Solar Eclipse to the foregoing one; but family afflictions, and want of health, have prevented me from further gratifying the reader's curiosity with disclosures of Indian mysteries.

<sup>(\*)</sup> The Sun rises at Madras on the 1st June at 5h. 39', the difference of the two accounts is therefore 2's

I shall therefore, take a final leave of the Kula Sankalita, and trust it to it's fate with all it's imperfections; taking this last opportunity for expressing my gratitude to the Supreme Government of India, to those of Madras, Bombay, and Prince of Wales' Island, for having, whilst the edition of this work was in progress, manifested by public acts, their approbation of the author's intentions, and perseverance, in a pursuit in which he only engaged from a sincere and unaffected desire of paying a tribute of respect, (which he thought might prove acceptable) to a Government in whose service he has spent the most active part of his life.

THE END,

#### A

## GLOSSARY AND INDEX

OF THE TERMS

OF

## HINDU ASTRONOMY

USED IN THE

# KALA SANKALITA.

Written in the year 1825.

\*\* When looking in the Glossary for the explanation of a term used in the Text, or in any other book of Hindu Astronomy, it may so happen that the orthography has been altered in such a manner in the former that it is not to be found exactly where it otherwise should be. In such a case the reader will remember that according to Sir William Jones' system, the letter C is generally sounded hard: but should this consideration prove insufficient, he must then look for a word, the sound of which comes nearest to that of the term which he is seeking.

## A GLOSSARY AND INDEX

Of the terms of Hindu Astronomy used in the Kala Sankalita, and in some other books treating of Hindu Astronomy.

The accompanying Glossary is the indirect, though necessary result of the investigation which constitutes the subject of this work. As it was not compiled by design, and as the terms which appear in its columns were gathered from various books, consulted only with reference to the task which the Author had undertaken, this Appendix can boast of no real importance as a Collection. But if it be considered as a Key to the Text, and as an exposition of the variations in its orthography which were occasioned by the introduction of Sir William Jones' system (now generally followed in Madras), it may prove of great assistance to the reader, not only for perusing these Memoirs, but any other book of Hindu Astronomy.

If it be considered that six and thirty years have hardly elapsed since we possessed any sound knowledge of the principles of that science;—that during the said space of time, it was only cultivated by five or six Gentlemen, most of whom were ignorant of the Sanscrit language, and who were widely dispersed over the immense territory subject to the British power in India, in every part of which a variety of idioms are spoken, no one will wonder to find so much dissimilarity in the manner of spelling terms which apply to none of the civil concerns of life, and several of which, many of the Natives of India never heard pronounced in the course of their lives. Nor can it be a matter of surprise if in many instances there remains still doubts in the minds of the learned of all countries, on the legitimate signification of certain technical terms, expounded by us, in this distant part of the world, when they see in Bengal the learned Colonel Dow write Obatar Bah (the name of the fourth Véda) what the Pundits of Madras spell Athara véda. (\*)

The Author has incautiously ventured to affirm in a note introduced at the foot of page 70 of the Text, that he has followed the orthography of Sir William Jones, Mr. Davis, and Mr. Scott; but he was not then sufficiently aware that these Gentlemen are far from having followed the same system; nay, that each of them did not in all cases write the same word alike. There is certainly a very sensible difference between the sounds elicited by the orthography of the term of Arca Baghabala and Arcabahu phala; and yet both bear the same signification according to the above authorities.

As for those terms which the Author learnt immediately from his native instructors, and which form a considerable part of this collection, he feels bound to declare that he is totally ignorant of the Sauscrit language, and that those technical words which he was the first to expound, were

<sup>(\*)</sup> Vide Dow's Hindustan, vol. I, dissertation page xxix.

conveyed to his ear, by interpreters either Telugu or Tamil, whose pronunciation of foreign idioms is known to be very defective. The exact meaning of a word so presented to him, he could not expound according to the common process of etymology; he could therefore only discover it, either from the nature of the operation in the course of which it was employed, or by its affinity to other words in some of the living oriental languages: but it was not until the whole of this work was actually printed, that he succeeded in procuring competent judges, and obtained adequate means for correcting his orthography. He trusts therefore, that the frequent variations, and seeming inconsistencies which will be noticed in the Text and Glossary, will not be ascribed to neglect.

With respect to the principal article, namely, the signification of the terms, the Author declares that he has not introduced a single exposition which did not come right home to his comprehension, either as to sense or application; and that he has borrowed none but from authentic and approved authorities.

In some few cases the Author and the Pundits whom he consulted, could not come to an understanding either as to the existence, or signification of a particular term; generally he relinquished the dubious expression when it was of little importance: but when he had cause to be satisfied that his sense of it was well established, he thought it his duty to persist, and insert it in his catalogue; but then the contested term is indicated by an asterisk.

In the arrangement of the articles it was found sometimes indispensable to follow the objectionable orthography in the leading column, because a different course would have perplexed too much the references; particularly in the use of the letter C, which (according to the system of Sir William Jones) supersedes in all cases the, sometimes, more appropriate K. For who would look for an explanation of the term Kendra in the right column, if (notwithstanding all warnings) it were announced to the eye by the word Cendra?—But the true spelling has always been observed in the Gloss, although it be not at all unlikely that the wrong orthography, more readily than the right one, would recal the term under consideration, to the recollection of a Telugu, or Tamil Sastri.



## A GLOSSARY AND INDEX, &c.

(N. B.—The Arabic figures refer to the pages of the Text, and the Roman to those of the Preface and Chronological Tables, being distinguished by Pr. and Chr. Table prefixed to each.—The Letter C is to be pronounced hard in all cases.)

#### A

- have occasion for this, they insert it between the 21st and 22d Nacshatras, in which case they take 3° 20' from Uttara A'shad ha, and 1° 40' from S'ravan'a; thus making it consist of 5°. It is chiefly used for Astrological purposes. Vide p. 309.—Abhijit, as a Yoga (or leading Star of a Lunar mansion) is the same as a Lyra. Vide p. 73, 74.
- A'CAS'A, (Coso 8)-A name for the Sky, or Firmament.
- ACSHA, (E)—Terrestrial Latitude.—Acsha-ansa, and Acsha Bhagas. Degrees of.—Acsha Carna; Hypo-thenuse; but in its Astronomical sense, means what Europeans call the Argument of the Latitude, as well as Patana Céndra. Vide from p. 94 to 96, and Tab. XXXIII, p. 44 of the Tables.
- ADIGAH, (Cops)—(so wrongly spelt in the Text, but properly) Athi, or Athica.—When this word is prefixed to the name or numeral of a Luni-solar year, it implies that it is embolismic, or of 13 Lunar months. Thus Athica Samvatsara means an intercalated year. Vide p. 71.—When to the name of a month, it indicates an intercalary one. Hence Athica masa means an intercalated month. Vide p. 71, 72.—And lastly, to the name of a Lunar day or Tithi, that it is repeated on two consecutive days in the Kalendar. Vide p. 72; also p. 65, 67, 68, 142, and Table XXIX.
- A'DITYA, (CES)—An epithet given to the Sun; meaning the Attractor.—Such a designation given by the Indians to that great luminary, may give rise to conjectures and speculations in the mind of the natural Philosopher.
- AGASTYA, ( X) X)-The Star Canopus.
- AGNI SAVARNI, (色为ないころ)—One of the 14 Patriarchs who preside successively over the 14 Man. wantaras of the Calpa. Vide p. 311.
- AGRA, (E) X)—Amplitude. Agra Bhagus; degrees of. Vide p. 91, 101.—Agrajya, sine of the Amplitude.

  Vide p. 102.
- AGRAHA'YANI, (ಆ) (written Agrahayan in the Text)—A new name given to the Solar month Margás'iras, when the latter was made to commence the year.—This event is supposed by some

to have occurred 698 years before Christ; when, according to the same authorities, the Ayanansa was accounted to be 6° 40'. Vide p. 5, 245, and article Ayanansa.

AHA'RGANA, ( ) The number of days from a given Epoch, to the time for which a computation is made. Vide Pr. p. vii; Text, 8, 9, 53, 171, 239, 241, 336, and Table XLI.—N. B. The term Ahárgana, is not used to express the number of days expired since the epoch of the creation. (See Strostidi Digona).

AHAS, (25 55)-The length of the artificial day. Vide p. 313, 318.

ALIPALA, (2340)—The 1.60th part of a Casta calá. Vide p. 6.

AMA'VA'SYA, (المحافقة من من المحافقة)—The conjunction of the Sun and Moon, also called Arcéndu-Sangama (written in the Text Arca-Indu)—Ama, and Darsa Tithi, are other names given to the Lunar day, on which the conjunction occurs; which is the Kalendar is always reckoned the 30th of the Lunar month. Vide p. 68, 70, 137.—Amávásya Tithi, the lunar day of the Moon's change Vide p. 78, 108.

AMRITA, ( ) The water of immortality, obtained by the churning of the ocean, and the occasion of the war between the S'uras, and As'ura's, in which the gods took a part. This indicates the occurrence of the first Solar Eclipse on Indian record. Modern European commentators conjecture that it fell on the 25th October in the year 945 before Christ.

ANALA, (2) Se)-The name of the 50th year of Jupiter's cycle of 60 years Vide I Chr. Table.

A'NANDA, (ピガロな)—The name of the 48th year of the same cycle. Vide do.

ANANTA, ( ) Tod) \_ Infinity; Eternity; Time; \_ also, the King of the Serpents.

ANANTA S'AYANA, (色がのあずないが)—Travancore. Vide Table XXXIII, p. 41 of the Tables.

ANGA'RACA, (Co TO & S)—One of the names of the Planet Mars.

A'NGIRA, (巴の名ど)—The 6th year of the cycle of 60 years. Vide I Chr. Table.

ANGULA', (40 K) A digit, or 1-12th part of any dimension; subdivided into 60 vy ingulus. Vide p. 92, 94.—Libit angula, digits obscured in an Eclipse. Vide p. 312.

AN'SA, (Go 3) - Degrees (Vide Bhaga). Also the numerator of a fraction.

ANURA'DITA, (とんってな)\_The 17th Lunar mansion. Vide p. 71.

ANTARA, (COSS)—(written Andra in the Text)—An intermediate space, a difference in computations.—

Antara viculus, surplus seconds. Vide p. 131 and Table XLVII, p. 63 of the Tables.

ANTERA, (2056)—Last.—Prathama, Madhya, Antera. First, mean, Last. Vide p. 103 referring to the Chara cumda.

A'RAMBHA, (色ざoむ)—Beginning.

ARCA, (ES)—One of the names of the Sun.

ARCABA'HU PHALA.SANSCARA, (అక్ బాహు ఫలసంస్థార్)\_In some Mss. Arcabhagabala (and

written in the Text, Area bahoota and Areabaghabala)—The arc which a Planet describes during that part of the equation of time, which arises from the inequality of the Sun's motion in his orbit: being an equation to which all the Planets are subject, but the motion of which it differently affects. Vide p. 87, 88, 184, 185, 190, and Table XXVII, part 2, p. 35 of the Tables.

ARCENDU SANGAMA, ఆ కొండు సంగమ)—The instant of true conjunction of the Sun and Moon. Vide p. 70.

AR'DHA, (CAF) -The half. Dina ardha; half the day: Ratri arda; half the night. Vide p. 106.

AR'DRA, (台ば) こ)—The 6th Lunar mansion. Vide p. 74.

ARPESI, ( \$\instrum\_{\text{N}} = 3 \)—The 7th month of the Solar year, Tamil denomination, answering to the Hindu month Cartiga during which the Sun is in the Sign Tula \$\sigma\$. Vide p. 5, and Table III, p. 3 of the Tables.

A'RYA BHATTA, (& )—A celebrated Hindu Astronomer who flourished in the 4123d year of the Culi yug, answering to A. D. 1322. He left several Mathematical tracts, some particularly relating to the properties of the Circle.

ARYA-SIDDHANTA, (30) & 20)—A treatise of Astronomy, composed by Arya bhatta, of which there is a spurious one. There is some variation in the copies of this work preserved in Bengal and in the Carnatic, the former making the Solar year 3650 15d 31p 17c 6", the latter 365d 15z 51v 15p; and the Lunar Synodical month, the former 29d 31g 50v 6p 7s,81, &c. and the latter 29d 31g 50v 5p 40s,21, &c.—N. B. The copy used in this work is that of the Carnatic. Vide p. 7, 66, 118, 199, 203, 239, and Tables XLVIII and XLIX, p. 63 and 64 of the Tables.

ARUNA, (20% 80)—The dawn, or Aurora, mythologically the Charioteer of the Sun.

A'SHA'D'HA, (世录英)—Parva the 20th, and Uttava the 21st Lunar mansions. Vide p. 74.—The 4th Lunar month. Vide p. 69.

A'SHA'D'HA, (うなな)—The 3d Solar month, Hindu denomination, when the Sun is in the Sign Mid'huna II, answering to the Tamil month Audi. Vide p. 5, and Table III, p. 3 of the Tables.

AS LE'SIIA, (いえな)—The 9th Lunar mansion. Vide p. 74.

ASTA, on ASHTA, ( )—Eight.—Asta' die. The S points of the compass, including the cardinal ones.—

N. B. This word is wrongly interpreted at page 52, where the Asta Dikas are stated to be the 4 intermediate divisions of the compass.

ASTAMI, or ASHTAMI, ( ) The 8th Lunar day of the Pacsha or demi.lunar month. Vide p. 70.

AS'URA' DHRUVA, (ఆనురధ్సవ)—The South Pole.

ASURAS, (Exo T)-Its inhabitants, opposed to the Súras, those of the North Pole.

A'S'WINA, (CA) The 6th Solar Hindu month, when the Sun is in the Sign Canya m, answering to the Tamil month Paratasi. Vide p. 5, and Table III, p. 3 of the Tables.

- AS WINI, ( A & S) .- The first Lunar mansion. Vide p. 74.
- ATHARAVANA' or ATHARA VEDA, ( ) The fourth of the inspired Vedas. This book comprehends the whole science of Theology, Metaphysics and Philosophy.
- ATCHU, (المحتر)-A term used by Father Beschi after the Southern Astronomers, to signify an Epoch.
- ATIGAND'A, (@3Xo&)—The Foga Star of the 6th Lunar mansion, perhaps the 133d of Taurus, but very uncertain. Vide p. 74.
- AVANTI, (むるつろ)-Supposed to be the ancient name of Ujani or Oogein. Vide p. 9.
- AVATA'RA, (心るでき)—Descents of the Deity in various shapes, and under various names, of which Rama, and Crishna are the most remarkable. Vide p. 311.
- AUDI, (182)—The 4th Solar month, Tamil denomination, answering to the Hindu Srávaná, when the Sun is in the Sign Carcáta 5. Vide p. 5, and Table III, p. 3 of the Tables.
- A'UNI, (C) D)—The 3d Solar month, Tamil denomination, answering to the Hindu A'shar, when the Sun is in the Sign Mid'huna II. Vide p. 5, and Table III.
- AVA'MA'HA, (色 またっか)—A term used in the Kalendar for expressing an expunged Tithi, or Lunar day. Vide p. 72, 319.
- AVANI, (ಆರ್. 3)—The 5th Solar month, Tamil denomination, answering to the Hindu Bhádra, when the Sun is in the Sign Sinha Q. Vide p. 5, and Table III.
- AYANA', (ಆರು ನ)—A name applied to the Equinoctial, and Solstitial points.—Mésha Ayaná; Tula Ayaná; the Vernal and Autumnal Equinoxes.—Uttara, and Dacshin'a Ayaná; the Northern and Southern Solstices.—Ayaná Bhagas, (vide Ayanáns'a)—Ayaná Cála; the time from an Equinox to the ensuing one. Vide p. 4, 76, 77, 308.
- AYANA'NS'A, (ప్రామంశ్)—The arc between the Vernal Equinoctial point, and the beginning of the Solar Sydercal (or fixed) Zodiac (or the first point in the Solar Sign Mésha γ), being one of the most important elements of Hindu Astronomy, as it refers the Sydercal, to the Tropical Zodiac. (Vide Cránti-Puta-Gati-Rishis). Vide also Pr. p. x, Text p. 19, 76, 84, 183, 246, 247, and Tables XXXV and XXXVI, p. 46 and 47 of the Tables.
- AYUSHMAT, (でかい 立って) \_ The Yoga Star of the 3d Lunar mansion, Alcyone. Vide p. 74.

B

BAD'ABA'NALA, (బడబానల)—A name sometimes applied to the South Pole.

BAHUDANYA, (బహుధాన్స్)—The 12th year of Jupiter's cycle. Vide Chr. Table I.

BA'LADITYACALU, (න හා සින්හින් හා (spelt in the Text Bulla dutty callu)—A Telugu Astronomer who wrote in the 4558th year of the Cali yug. Vide p. 9.

- BALARAMA, (2000-5)—The Sth Incarnation of Vishnu as a Cshetriya, the anniversary of which is noticed in the Kalendar. Vide p. 311.
- BALAVA, (るでき)—The second Carana. Vide p. 75.
- BAVA, (& 5)-The first Carana. Vide p. 75.—Also the name of the 8th year of the cycle of Jupiter. Vide I Chr. Table.
- BHAGAH, ( )—An arc equal to the 1-360th part of the circumference of a Circle; or one degree, Vide p. 77.—Bhaga. Anubanda, or Aparácha; an infinite series. Vide p. 93.
- BHAGAN'A, (XXX)—The circumference of a Circle.—Independently of Astronomical purposes, the Indians frequently divide the circumference of the Circle into 12 Ras'is or Signs, subdivided sexagesimally into Bhagas, Calás, Vicalás, &c. i. e. degrees, minutes, seconds, &c.; vide p. 85.—Bhagan'a means also a revolution.
- EHA DRAPADA, (ఫాండ్రపడ)—Purva the 25th, and Uttara the 26th Lunar mansions; vide page 74.—The same word, or merely Ehadra, is the name of the 5th Solar Hindu month, answering to the Tamil Aucani, when the Sun is in the Sign Sinha Q. Vide p. 5 and Table III, also p. 232.
- BIIAGAVATA, (マッグまる)—An historical book, reckoned authentic.
- BHANU, (\$\overline{\pi}\overline{\pi}\$)—A name or epithet of the Sun.—Bhanu Husputtia Chandra manu, or properly Barhuspatya manu. Vide Manu, also p. 148.
- PHARANA, (ガンピ)-The second Lunar mansion. Vide p. 74.
- IMA'SCARA, A'CHA'RYA. ((A) A) To Do C) An Indian Astronomer who wrote a commentary on the Arya Siddhanta. He is stated in Hindu books, to have flourished in the 4252d year of the Cali yeg (A. D. 1150); but it is known that he was posterior to A'rya bhattá who wrote his treatise in A. D. 1322.
- PHAUCHYA, (\$\frac{1}{2}\$)—One of the 14 Patriarchs who are supposed to preside successively over the 14 Manwantaras of the Calpa. Vide p. 311.
- BHAUMA, (みな)-One of the names of the Planet Mars.
- BHRIGU, (35) K)-A name of the Planet Venus.
- EHU, (Auso) Seems to imply the middle place. Bhí chacra, when applied to the Celestial Sphere, means the Equinoctial line. Bhú carná, the Radius of the Equator. Bhú paridhi, the same as Bhú chara.
- BHUDRA, or YUSTI, (ダ த)-The 7th ordinary Carana. Vide p. 75.
- BHUJA, (\$\times \times )=1s an astronomical argument, peculiar to Hindu astronomy; it is to be considered as follows: 19 If the arc exceeds 3 Signs—subtract from 6 Signs. 29 If it exceeds 6 Signs—subtract of Signs it therefrom. 39 If it exceeds 9 Signs—subtract from 12 Signs; vide p. 85, 86, 114.—Bhujaja; the sine of the Bhuja.
- DHUMI, (50000)-The Terrestrial Globe, supposed to be in the center of the universe.—Bhumi savana;

- proper, natural to the Earth.—Bhumi sávana dina; a natural day. Vide p. 5, 78, 79, 101, 106, 239.
- BI'JA, (\$2:)—(sometimes written Becjah in the Text).—An equation or correction. Vide p. 38, 84, 199.
- BORNA COTI, (& 80 = \$ 60).—The third imaginary city, supposed to lie under the Equator at 90' from Lanca. Vide p. 9.
- BRAHMA, ( & 5)—The first person of the Hindu triad, and the Creator of the world: no direct worship is addressed to Brahma; and no temples are dedicated to him.
- BRAHMA A'CHA'RYA BRAHMA GUPTA, ( ) Supposed by some to be one and the same Astronomer, and the inventor of the system disclosed in the Súrya Siddhánta—by others to be two distinct commentators of that Sastra.
- BRAHMA SA'VARNI, (ప్రస్తున్నానికి)—One of the 14 Patriarchs who are supposed to preside successively over the 14 Manwantarus of the Calpa. Vide p. 311.
- BRAHMA SIDDHA'NTA, (ప్రస్తు హ్లాస్ట్రిప్ సిద్ధాంక)—The second of the authentic Sastras.
- BRAHMA'NDA', ( ) ( ) The mundane egg, created by Brahma—also the visible sky, which is supposed to be the shell of this egg.
- BRA'HMYA, ( ) SS-(written Brahman in the Text)—The Yoga Star of the 25th Lunar mansion, a Pegasi. Vide p. 74.
- BRISYA, (టైజయ, విషు)—called Vishu in the Carnatic —The 15th year of the cycle of Jupiter. Vide I Chr. Table.
- BRITASTA'N, (ಎ) (ಎ) (b) Mentioned in the Brahmánd'a Purana, as the place of religious duty, is supposed by some, to be the Island of Great Britain. It is also called Swita dwip, or the White Island—Suvarná dwip, or the Golden Island, is conjectured to be Ireland. The British Islands are (it is pretended) sometimes called Chandra dwip; and likewise Tricalas'a, or the Island with three Peaks, viz. Rajátacútá, Ayacúta', and Suvarná cúta'.
- FUDIIA, (松്文)—One of the names of Mercury—also a godhead, the founder of a religious sect, which is followed in different parts of India, and in all China. The epoch of the institution of Budha's religion is referred to the year 540 before Christ. According to Hindu Mythologers, he was the son of Sóma (the Moon) and the head of a dynasty, called on that account, the Lunar line of Princes. He flourished in the beginning of the Treta yug. Modern commentators place his birth in the year 1424 before Christ.—Budha-vara; Wednesday. Vide p. 6.

C

CACSHA, (& .)—The orbit of a Planet, or the circle which ancient Astronomers called the Deferent; for the Cacsha carries Epicycles, (Paridhis) like the Deferent. This term is alluded to at p. 84 and 85 of the Text, and 247, IId Appendix.

- CAL'A', (\$50)—An arc of one minute of a degree: also the Phases of the Moon, of which the Hindus count

  16.—Mahá Calá; the conjunction or opposition of the Sun and Moon; vide p. 77.—Lagna
  Calá. Vide p. 102.
- CA'LA'NILAM, (3000)—One of the elements of the Vácyam (spelt Vakiam in the Text) process; and containing 3031 days.
- CA'LAYUCTI, (まずないま)\_The 52d year of the cycle of Jupiter. See I Chr. Table.
- CALI, or CALCI, (\$3, \$3). The 10th Incarnation of Vishnu in the shape of a Horse with a human head; vide p. 311.—Its anniversary noticed in the Kalendar.
- CALLYUG, (\$\instructering \text{X})\to The fourth of the periods contained in a Maháyug. The iron age—consisting of 432000 Solar Sydereal years. Its epoch, i. e. that of its beginning, ascends to 3102 years before the Christian \( \text{Era.} \) Vide Crita yug, also p. 7, 8, 77, 222, 228, 293, 302, Table LI, p. 68, and I and II Chr. Tables.
- CALPA, (Sex)—literally Form.—The grand period of general conjunction. It consists of 4320000000 Solar Sydereal years; being the sum of 14 Manwantaras, with a Sandhi, or twilight of 1728000 Solar years; vide Manwantara; also p. 77.—Calpa dina, the day on which the Calpa began, or its anniversary, which is noticed in the Kalendar. Vide p. 319.
- CANYA, (& SS)-The Hindu Solar Sign Virgo m. Vide p. 5, and Table III.
- CARCA'TACA', (まっことが)—(spelt in the Text Carcata)—The Solar Sign Cancer . Vide same pages as above.
- CARANA, (§ 82)—(spelt in the Text Curna)—An astrological element importing the time during which the Moon's motion from the San amounts to 6°: there being 2 Caranas in one Tithi.—The Moon's synodical revolution is divided into 11 Caranas, 7 of which are ordinary and moveable, called Chara; and 4 extraordinary and fixed, called Sthirra—the time when the successive Caranas end, is inserted in the Ephemerides. Vide p. 73, 75, 79, 307.
- CARNA, (SEE)—The hypothenuse of a right angled Triangle—Chala carna (spelt Chila carna in the Text) the true distance of a Planet from the Earth, in contradistinction of its mean distance, represented by the Radius of the Deferent. When this term is so understood, the Sudh'a coti, and Bhujajya, form the other two sides of a right angled Triangle; vide Bhú carna, also p. 96, 98.—Carna márgám; a straight, or perpendicular line: also a ray of the Sun.
- CA'RTICAY, or CARTIGA, (5.25)—The 7th Hindu Solar month, when the Sun is in the Sign Tula 2, answering to the Tamil Arpesi.—In the Southern parts of the Peninsula the Tamil month which is called Cartiga, is the 8th of the Solar year: care must therefore be taken not to confound these two Carticays. In the Text the Southern name is invariably given to the 8th Tamil Solar month.—Lastly, Carticay is also the 8th Lunar month of the Lunisolar year. Vide p. 5, 69, and Table III.

- CA'SI, (378)—Benares, a city which according to Hindu Geography lies in 27° 25' of Latitude N. and 4° 37'

  E. of Lanca. Ville Table XXX!H.
- CASTA'CALA', (またなど)—A division of time equal to the 1-2000th part of a Vicalá. Vide p. 5,77. CAULAVA, (まため)—The 3d ordinary. Carana. Vide p. 75.
- CHACRA, (&).-A Wheel; a Circle; a Cycle of years; a weapon of a circular form often placed in the hands of the gods.-Rási chacra, the Zodiac.-Varahaspati chacra, the cycle of 60 years.-Nac-shatra chacra, the sphere of the fixed Stars.-Prac chacra, an epicycle on which the degrees of precessional variation are counted. Vide p. 5, 84, 85, 147, 200, 275.
- CHADAM, (\$\times\_0\$)\_An element of Spherical Trigonometry used for finding the Sun's altitude at a given instant.

  Vide p. 99.
- CHATUSHPA'DA, or CHADESPADA, (がどうな)とThe 9th Carona, being the 2d extraordinary. Vide p. 75.
- CHANDRA, (So E)—The most common name of the Moon.—D's Madhyama Graha, vide p. 83; Do. Sphuta

  Do. 88; D's Madhyama Gati, 89, 131; Do. Sphuta Do. 89; for D's P'hala, 123, and Tab.

  XXIII, XXV, XXVI; D's Mana, vide p. 5, 57, 214, and II Chr. Table.—Chandra panchanga, the Luni-solar Kalendar. Vide p. 507, 318 to 322.
- CHARA CANDA, on CUMDA, (\$\times \times \times \times \times \con \times
- CHARA, (など)—The 7th and ordinary Caranas when named collectively, (spelt Charra in the Text). Vide p. 75. CHARUM, (までどの)—Vide Pádachárum.
- CHALA CARNA, (ZOSE)—(Written Chie carna in the Text)—Vide Carna.—This term means the true distance of a Planet from the Earth, in contradistinction to its mean distance, or the Radius of the Caesha, or Deferent. Vide p. 186, 189, and the Tables from XLI to XLV.
- CHATURDASI, (公的なども)—The 14th day of the Lunar Pacsha. Vide p. 70.
- CHATURTHA P'HALA, (WEXET)—The second inequality or equation of a Planet, answering to the annual Parallax of a superior Planet and the elongation of an inferior one.
- CH'HA'YA', (\$\to\$\times\_)\to\$-(written Chya in the Text, and spelt in a variety of ways in European books which treat of Hindu astronomy; sometimes Cháya)—Shadow.—Under this term we have a variety of elements which are multiplied by mistake in consequence of Europeans varying their manner of writing oriental words.—Vishuva ch'ha'ya', the Shadow of a Gnomon, when the Sun is in the Equinoctial points.—Madhyama ch'ha'ya', the midday Shadow of the same at any other time of the year.—Sama mandala ch'ha'ya', the midday Shadow of the same when the Sun is East or West

of the Gnomon; vide p. 84, 91, 94, 186, 189.—Ch'haya sula; one of the names of Saturn, meaning Born from Darkness.

CHITRA, CHAITRAM, (& 5, 33)—The 1st month of the Tamil Solar year, (always spelt Chaitram by F. Beschi, and in the Text) answering to the Hindu Vaisac'ha, when the Sun is in the Sign Mesha Y.—But this name is that of the last month of the Hindu Solar year used every where (excepting in the land of Tamil,) when the Sun is in the Sign Min X, answering to the Tamil Pungoni: a circumstance which must be carefully attended to; vide p. 5, and Table III.—Lastly, Chaitra is the name of the 1st month of the Luni-solar year which begins on the new Moon preceding the Sun's entrance in the Sign Mesha Y; vide p. 69.—N. B. This variety of significations of the same term or rather of terms so nearly resembling each other, requires the greatest attention, when adverting to dates, and reading books written in different countries.

CHITRAB'HANU, わしあかめ)—The 16th year of the cycle of Jupiter. Vide I Chr. Table.

CHOUTI, (るでも)\_The 4th day of the Lunar Pacsha or demi-lunar month. Vide p. 70.

CILACA, (\$08)—(the C to be pronounced hard)—The 42d year of the cycle of Jupiter. Vide I Chr. Table.

CIMASTUGHNA, or RHIMUSTOGUNA, (కేమస్తుక్కు o)—(the C to be pronounced hard)—The 11th and extraordinary Carana. Vide p. 75, 318.

COT'I, (5 62)—The complement of an arc to 90': also one of the sides of a right angled triangle.—Sudda coti; the sine.—Cotijya, the cosine of an angle in such a triangle.

CRADI on CRODHI, ( ) The 38th year of Jupiter's cycle. Vide Chr. Table I.

CRAMAJYA, ( ) 50 25)—The sine of a Planet's declination.—Paramapáma-cramajya, the sine of its greatest declination, (written Paramapa in the Text). Vide p. 92.

CRA'NTAM, (5050)—(in the Text Crantum).—An astrological element, explained at p. 308. Vide also p. 76 and Kalendar.

CRA'NTI, (300)—literally, Ascending, surmounting;—astronomically, declination; vide p. 5, 84.—Cránti bhagas, the declination of a point of the Ecliptic; vide p. 91, 97.—Cránti cacsha, or mandala, the Ecliptic; vide p. 91.—Cránti jya, the sine of the declination; vide p. 105.—Cránti pata, literally the Nodes of the Ecliptic, or the Equinoctial points.—Cránti Pata-Gati, literally the motion of the Nodes of the Ecliptic, but more precisely what Europeans call precessional variation. Vide p. 86, 247, and refers to the whole of Appendix II.

CRISHNA, (8) and One of the Avatáras, or descents of Vishnù; supposed to have lived at the time when Yudhisht'hira flourished, but whose epoch, according to Mr. Bentley, descends to A. D. 600. As Vishnù is a personification of time, so is his identical incarnate being.—As a hero, Crishna's feats are recorded in the Máhábhárata, a celebrated poem describing a fictitious war—The anniversary of this incarnation is noticed in the Kalendar. Vide p. 311.

CRISHNA PACSHA, ( ) & & & & ( ) — The latter, or dark half of the Lunar month; also called Bahula pacsha.

Vide p. 68, 314, 320.

CRITA YUG, (変)るがが) Vide Salya yug.

CRITICA, (8) 38)-The 3d Lunar mansion. Vide p. 74.

CRO'DHANA, ( 変う) 本る)—The 59th year of Jupiter's cycle. Vide Chr. Table I.

CHAIA, ( ) To wane, to waste, to decline.

CSHAYA, (A)—Derived from Cshai.—Cshaya tithi, an expunged Lunar day.—Cshaya masa. Do. Lunar month.—Cshaya samvatsara, a Luni-solar year with two intercalary and one expunged months.—Cshaya Varahaspati mana, a year expunged out of Jupiter's cycle of 60 years. Vide p. 64, 68, 71, 72, 78, 79, 137, 142, 206, 209, 301, and Hd Chr. Table.

CSHE'PA, ( )—A constant number to be added in certain computations to fit a particular epoch; in contradistinction of Sodhya which is to be subtracted. Vide Pr. p. xi, Text p. 51, 203, 239.

CSHE'SHNA, (でんない)\_The part of the Moon's disc obscured in an Eclipse. Vide p. 343.

CSHETRA GANITA, (でよび) Geometry. Cshetra Dersa. A treatise of.

CSHITI'JA, (CACSHA),—(2, 32, 56)—The horizon.—Cshiiijya, the sine of an arc referred to the horizon, used for finding the ascensional difference. Vide p. 91, 98, 105.

CSHYA, (めん)—The 60th year of Jupiter's cycle. Vide Chr. Table I.

CUJA, (\$\iotiz) - One of the names of the Planet Mars.

CUMB'HA, (知のな) - The Hindu Solar Sign Aquarius m. Vide p. 5 and Table HI.

CUME'RU, (めるめ)—The Southern hemisphere, or Pole—a fabulous region where Yama presides over the A'surás and Daityaz. (Vide Sumeru).

CURMA, (& - )-The 2d Incarnation of Vishnu in the shape of a Tortoise. Vide p. 311.

D

DACSHA SAVARNI, (とうないまだっ)—One of the 14 Patriarchs who preside successively over the 14 Manwantaras of the Calpa. Vide p. 311.

DACSHINA, (డర్మీణ)—The South point of the compass.

DAITYAB, ( SS) - Vide Asurás.

DANDA, (GHATICA),—(たoば)—The 1.60th part of a day, so called in the mode of dividing time called Murta. Vide p. 5, 77.

DARSA'NA, (さずらる)—Intuition.—Ananta dareana, infinite knowledge.

DES'A, ( 5) -A country or region. Niracsha dés'a, the Equatorial parts of the Earth.

DESAMI, あるな)-The 10th Lunar day of the Pacsha. Vide p. 70.

DESANTARA, (25005)—The distance of any two meridians or the surface of the Earth; or what Europeans call Longitude.—Also the difference of Longitude, or allowance made for a Planet's proper motion, between the time of its being upon the first meridian, and its coming to that of a given place. But this is not to be understood in the same sense as what Europeans call the Longitude

of a Planet. Vide Sayana, also p. 95, 107, 109, 130, 131, 131, 135, 338, and Tables XXXIII, XXXIV and XLVII.

DE'VARAM, ( at 50)—An element of the Vacyam process containing 248 natural days. Vide p. 121, 132, 133, 335, and Table XXVI.

DE'VATA'S, ( a source source)—Benign spirits governed by Indra, properly the inhabitants of the North Pole; for the Dévatás are said to have day, when the Daityús have the night, and vice versa. Vide Surás.

DE'VI, ( D)—A term used in the Kalendar to signify day time. Thus Tyáyyá Devi (wrongly spelt Thyojum in the Text) means that the Tyájyá occurred at day time. Vide p. 75, and Appendix IV.

DHANA, (なる)—The sign of affirmation, or addition, of the same import with + or plus.

DHANISHTA, (本の家)-The 23d Lunar mansion. Vide p. 74.

DHANUH, DHANUS, or CHA'PA'M, (本め8,本めぶ)—An arc of a circle.

DHANUR MARGAM, (あるなっとFO)—A curve line.

DHANUS, (ధనుస్)—The Solar Sign Sagittarius 2. Vide p. 5, and Table III.

DHATA, (ఫారు)—(Vide Ghati'ca-dandas, and p. 5.)—Dháta, the 10th year of the cycle of Jupiter. Vide Chr. Table I.

DHANWANTARI, (なる) o o o)—The celestial Physician, who was produced by the churning of the ocean.—
Time.

DHRITI, (\$5,8)-The Yoga Star of the 8th Lunar mansion, 3 Cancri. Vide p. 74.

DIRUVA, (\$\sigma\$)—Generally the Pole of a great circle of the Sphere—Particularly the Celestial Poles.—Ultara Dhruva, the North Pole; also the Polar Star.—Dacshin'a Dhruva, the South Pole.—This term is also used to signify a constant arc, referring to the distance of a Planet from the beginning of the Sydereal Zodiac.—Dhruva means more commonly an epoch to which a computation is referred. Lastly, it is the name of the Yoga Star of the 12th Nacshatra, supposed to be the same as \$\beta\$ Leonis. Vide p. 74, 85, 123, 133, 144, 152, 182, 230.

DIC, (E)—(wrongly spelt in the Text Dikas)—The four cardinal points of the compass.—Astá dic; the 8 principal points including the cardinal ones; and wrongly stated in the Text at p. 92, to mean only the 4 intermediate points.—The Astá dic are called the eight corners of the world, over each of which a divinity is supposed to preside. Vide p. 92.

DINA, (DN)—A day, considered in a great variety of ways and durations, of which the following are the principal.: 10 A Sávana, or Bhími sávana dina. A natural day, being the time between two Sun risings. 20 A Saura dina; of these there are two kinds; and the similarity of the name tends to confuse much the beginners in the study of Hindu Astronomy. First; the absolute sense of Saura, being Sydereal, the Saura dina is the time between the same point of the Ecliptic rising twice; or, more precisely, the time between the Equinoctial points rising twice. Second, the other Saura dina, is the time which the Sun takes to describe one degree of the

Ecliptic. It follows therefore, that strictly speaking, neither of these kind of days are equal throughout the year; yet the former, (which is also called Núcshatra dina) are supposed to be so in the first steps of several operations. Such is also the case with the latter, but this only happens when calculating the mean elements of the Planets by the Vacyam process. 30 Diva dina, is equal to a Sydereal revolution of the Sun. 40 Pitrya dina, to a Synodical revolution of the Moon. 50 Brahma dina, is equal to a Calpa, or 4320000000 years, his nights being equal to his day.—Yuga dina, is another word for Ahargana, meaning the number of days expired from the commencement of a Yug.—Lastly, Yuga dina means the auniversary day of that on which a Yug began, which is always noticed in the Kalendar.—N. B. This term is to be found in every part of the work, and therefore needs not be particularly referred to. Vide, however, p. 5 and 77.

DIN.A'RDHA, (なっちゃ)—Half the time of the Sun being above the horizon. Vide p. 92, 106, 318.

DUADESI, or DWADESI, (あなど)—The 12th day of the Pacsha, or demi-lunar month. Vide p. 70.

DUNDUBHI, (మందులే)...The 56th year of Jupiter's cycle. Vide Chr. Table I.

, DURGA, (ぬメテ)—A personification of the Solar year.

DWA'PARAYUG, (云气 如公文)—(wrongly spelt in the Text Decapar yug).—The third of the periods contained in a Mahá yug. Its duration is of 864000 Saura years. The brasen age of the Hindus. Vide p. 7, 77.

DWIJYA', ( SS)-The Sine; but more properly the Chord of an Arc; vide Jiva,-Also the Sine of the San's declination when his Longitude is II Signs. Vide p. 101.

DWIJYA' MA'RGAM, (ぬん とっと メテロ)--An horizontal line.

DWIJYA' PINDA', (总分本) Suc of 3° 45'; vide Pinda, also the whole of Article 8 of Part I of the Key to the Siddhanta Chandra mana; and Table XXX, p. 39 of the Tables.

DWI'PA, (ష్ట్రీ ప)—An extensive region or continent.

G

GANDA', (XOS)-The Yoga Star of the 10th Lunar mansion, Regulus. Vide p. 74.

GA'NE'SA', (X E )-One of the names of the god of wisdom.

GANITA S'A'STRA, (X జీత శా స్ట్ర)--Astronomy. A treatise of.

GARGA, (XXF)—An ancient Astronomer; the Guru, or instructor of Yudhisht'hira, one of the Princes of the Lunar line.—That Garga was cotemporary with Yudhisht'hira is contested by some modern commentators, who assign the year 548 before Christ for the time when he flourished.

\* GARUD'A, (X 5)—The Bird of Vishnu. An epithet of the Sun: but not admitted by the Madras Pundits. GATI, (X 3)—Generally, motion.—Specially, the diurnal motion of a Planet in its orbit; vide p. 88, 89, 107, also Tables XX, XXI for the Sun and Moon, and the first part of Tables XLI, XLII, XLIII,

- XLIV, XLV for the daily motion of Mars, Mercury, Jupiter, Venus, and Saturn.—Madhya Gati; mean motion.—Sphuta Gati; true or apparent motion.
- GAUN'A CHA'NDRA MA'SA, (గాణబాంధ్రమాన)—The Lunar month when it begins at the full Moon, called secondary.
- GHATICA, (んどど)-An Indian hour, 21 minutes European time, (vide Danda).
- GRAHA, (X) 50)—The Planets.—A moveable point in the heavens. The Planets have each a great number of names, or epithets; many of which are to this day unknown to Europeans. The following, however, are known to every Indian, because they serve to give a name to the seven days of the week: 10 Ravi, or Surya; the Sun. 20 Chándra, or Soma; the Moon. 30 Mangala, or Cuja; Mars. 40 Budha; Mercury. 50 Guru, or Vrihaspati; Jupiter. 60 Sucra, or Bhrigu; Venus. 70 Sáni, Saturn. Vide p. 6.—Besides these, the Hindu Astronomers consider Ráhu, the Moon's ascending, and Cétu her descending Nodes, as obscure Planets, which occasion the Eclipses of the Sun and Moon. Vide p. 303.—The Tables from XLI to XLV give the mean motion, Anomalistic equation and Annual equation of the five Planets known to the Hindus.—Graha, when the terms Madhya and Sphuta are prefixed to it, signifies the mean, and apparent place of the Planet in the Hindu Sydercal, or fixed Zodiac. Vide p. 83, 87, 280.—Graha lághava; a treatise on Astronomy, written about the 4657th year of the Cali yug (A. D. 1555.)
- GRAHANA', (X) 500)—General term for an Eclipse; vide p. 343.—(Grahana tinooria padhi, a term used by common Kalendar makers for half the duration of an Eclipse, but the word Tinooria is not recognized by the regular Sastries). Vide p. 345.
- GRAHA PARIVRITHI, (グぶるのま) 型)—An account of time used by the inhabitants of the Southern Provinces of the Peninsula of India. It consists of a cycle of 90 Solar Sydereal years of 365d 155 31v 30p Indian, or 365d 6h 12' 36" European time. Vide p. 51, 295, 302, 303, and Table II, p. 2 of the Tables.
- CRISHMA, ( ) \_ \_ The 2d Season of the year, comprehending the months Jyest'hu, and A'shad'ha, when the Sun is in the Signs Vrisha &, and Midhuna II; answering to the Tamil months Viassei and Auni. (\*)
- GUDIYA, GHATI'CA, (మద్దమ, మట్రాం)—(spelt in all this work Guddia)—Ghatica, the Sanscrit, and Guddia, the Telugu, names of a space of time equal to 1-60th part of the natural day, or 24 minutes of European time: the same as a danda. It is divided sexagesimally into vigudiyas, paras, euras, &c. The Gudiya referring to time, must be distinguished from an arc of the same name, which divides a Lunar mansion, or Nacshatra, (13° 20') into 60 parts, subdivided likewise sexagesimally as the measure of time into vigudiya, &c. Vide p. 6, 77.

<sup>(\*)</sup> It has been observed at page 4 in the note (†) that the Tamils reckon their Seasons to begin one month later than the rest of the Hindus; so that in the present case the Tamil Season of Grishma would comprehend the months of Auni and Audi. In order not to perplex the reader's attention by multiplied explanations, the present observation will not be repeated in the other articles which refer to the Seasons.

GURU, (人) )—One of the names of Jupiter; also a spiritual guide, preceptor, teacher, &c.—Guru vara, Thursday. Vide p. 6, and Table XLIII.

II.

ΠΛ'RAM, (55 80)—The denominator of a fraction.

HARSHANA, (おるころ)—The Yoga Star of the 14th Lunar mansion, Spica Virginis. Vide p. 19, 74.

HASTA, (సాస్ట)—The 13th Lunar mansion. Vide p. 74.

HEMALAMVA, or HE'VILAMBI, (ేవా నిళ్లమి)—The 31st year of the cycle of Jupiter. Vide Chr.
Table I.

HE'MANTA, (క్రామంత)—The 5th Season of the year, comprehending the months of Margasiras and Paushya, when the Sun is in the Signs Vrischica m and Dhanus 1, answering to the Tamil months Cartiga and Margali.

HO'RA, (一気でいど)—The 1-24th part of the natural day, answering to an European hour. A measure of time probably introduced in India by the Europeans.

I

- ICSHWA'CU, (See Su)—The first king in the Solar line, who reigned at the commencement of the Tretu yug. He was the son of the 7th Menu, or Pitriarch, the offspring of the Sun. His posterity was called in consequence, the dynasty of the Solar Princes, in the same manner as Budha was reputed the head of the Lunar line. Modern commentators bring the time of his accession down to the year 1320 before Christ. Vide p. 311.
- INDRA (MAHA'), (20 5)—The god of thunder; a personification of the sky—The chief of the Dévatas, or Súras (vide Dévatas);—also, the Yoga Star of the 26th Nacshatra, Y Pegasi. Vide p. 74.
- INDU, (つんめ)—A name of the Moon. That name is commonly given to her when that of Arca is applied to the Sun; or in a compound form. (Vide Arc'endu Sangama).
- 18'WARA, (本まなど)\_The 11th year of the cycle of Jupiter. Vide Chr. Table I.—Also, an epithet of Siva. (Vide Siva).
- ITIEK, (S)—Two syllables added by certain Southern Astronomers, to the name of a Lunar month when it is an intercalary one. Thus Phalguna-Itick indicates that the said Lunar month is to be repeated. This term is a compound of Iti, this is; ek, one; signifying that the month so named is that which is truly intercalated, the month Phalguna which precedes it, being the Nija or proper one. In the Carnatic, however, the same month would be called Athica Chitra, and the following Nijah Chitra, the first being that which is intercalated; so that according to either denomination the intercalated month is the same.
- JAISHTHA, ( )—The second month of the Hindu Solar year, when the Sun is in the Sign Vrisha & answering to the Tamil month Viassei. Vide p. 5, and Table III.

- JAMBU DWI'PA, (2000 & a)—One of the seven grand divisions of the Earth, including Asia; so named from the tree called Jambú abounding in it.—Modern commentators, however, pretend that it refers only to certain parts of the interior of Asia.—The Eden of the Hindus.
- JAMNA PATRICA', (జన్మప్రికా) What Astrologers call the Nativity. The aspect of the Planets in the heavens, at any proposed instant of time.
- \* JANU, (2000)...Literally means the Knee. It is therefore difficult to understand why in some places it is used as an epithet of the Sun.
- \* JANU SEPTAMI, (జానుస్ట్రమ్లు—In some books is a term used to indicate the beginning of the year; but it is unknown as such to the Pundits of the Carnatic.
- \* JARA'SAND'HA; (窓であるな)—The name of a celebrated king who reigned in Maghadu, the head of a dynasty which followed that of the Solar and Lunar lines.
- JI'VA, (25)—(sometimes written Jya or Jaya in European books on Hindu Astronomy.)—The Chord of an Arc; but frequently written for Ardha.jya, "half the String of the Bow", which comes to the same as our definition of "half the Chord of double the Arc." Vide p. 92, and Table XXX, with demonstrations from p. 39 to 42 of the Tables.
- JYA' PINDA'S, (2 5 20 23)—The Sines of the 24 Pindas (3 45' each) into which the Quadrant is divided.

  Vide as above.
- JYA'TACA, ( జూ తక) Astrology. A Horescope. Jyálaca Sástra. A treatise on.
- JYEST'IIA, (尼克公)—The 18th Lunar mansion. Vide p. 74.
- JYO TISH SA'STRA, (& South Sastri, a title assumed by the Indian Astronomers, (always wrongly spelt in the Text Jyautish Sastras). Vide Pr. p. iii, and Text p. 281.
- JYOTISHITAVA, (జూ లే ప్రవ)—A treatise on Astrology. Vide p. 197, 202, and Tables XIV and XIX.

## К

- KA'LA, or CA'LA, ('See)—(always written Kala in the Text).—Time in its natural acceptation. This term, as it sounds to the ear, is applied to a great variety of mathematical and astronomical subjects, several of which may be collected out of the expositions contained in this Glossary.
- KATAPAYA'DI, (కటపుడూడి)—Special Arithmetic; of the same import as Algebra.
- \* KAUSTUBHA, ( ) —An epithet of Vishnú. A sparkling gem, worn by that deity; elicited by the churning of the ocean: it is in some places taken as an emblem of the Sun; but the Pundits of the Carnatic do not admit of that allegory.
- KENDRA, (30 &)—and (according to Sir Wm. Jones' orthography) Céndra.—Answers to what Europeans call the argument of an equation.—Patana céndra, the argument of the latitude.—Dwiliya céndra, the supplement to a whole circle of what Europeans call mean anomaly; being the distance of the higher Apsis, from a Planet in any point of its orbit.—Sighra céndra, the commutation;

being the distance of the Sun from a superior Planet; or the distance of an inferior Planet from the Sun.—Manda céndra, the argument of anomaly. Vide p. 87, 88 and other places.

KETU, on CETU, (一覧が)—The Moon's descending Node. Vide Graho, also p. 77, 303, 310.

HRITA, on CRITA YUG, (\$\infty \infty \infty).—The same as Satya yug; the golden age of the Hindus; which consists of 1728000 Solar Sydereal years; being the first of the four periods contained in a Maha yug. Vide p. 7, 77.—N. B. Some Astronomers and Commentators, reverse the numerical order of these yugs, and would therefore call this the fourth.

## L

- \* LACSHMI', (Example 1)—The name of the goddess of wealth.—This word applies to a multifude of objects; too numerous to be repeated. In some parts of Northern India Lucshmi is a personification of the Luni-solar year; in the same manner as Durga is that of the Solar one: but this allegory is rejected by the Pundits of the Carnatic, who likewise deny what some pretend, that she lends occasionally her name to the Moon, and even to Jupiter.
- LAGNA, (exx)—The Arc of the Equator which passes the Meridian in the same time with each Sign of the Ecliptic; and as Lanca is supposed to lie under the Equator, its Lagna, is called Madhya lagna.

  —Lagna bhuja, means the Ascensional difference. Vide p. 22, 101, 102, 104, and Table XXXII.
- LAMBA, (202)—The Co-latitude, or the Arc between the Pole and Zenith of a given place.—Lambajya; its Sine, or the Cosine of the Latitude. Vide p. 94.
- LANCA' (© 0 50)—One of the four imaginary cities which are supposed to lie under the Equator at 90° distance from each other; viz. 10 Yavacót'i; 20 Lanca; 30 Romaca; and 40 Siddhapuri. At page 9 of the Text, Bornacoti was stated to be the 3d; but the Pundits have rejected that spelling.—Lanca is considered by all manner of Indian Astronomers, to lie under the first Meridian: to which all computations should be referred; though several (and particularly the Telugus) refer to that of Raméswara. Towards the North, and under the same Meridian as Lanca, the Sastra states that there are two other cities and a great mountain, viz. Avanti (supposed to be the same as Ujani, or Oogain), Rohitaca, the mountain, and Sannihita sarah, which in former, or rather fabulous times, were the seats of Colleges and Observatories. The Meridian of Lanca lies in 75° 53° 15" (5h 3° 33") East of Greenwich; and 73° 33' (4h 54' 12") East of Paris. Vide p. 9. N. B. all the operations contained in this work which always refer to that Meridian.
- LATTA, (e) 750)—An element of astrology. Vide p. 76, 309, and Appendix IV.
- \* LIBITA, (Dan)—(Mandala Yogarda),—The side of a Spherical Triangle, with the argument of the Latitude of a Planet, and its Latitude for the other two.—N. B. The Tamil Astronomers resolve this Triangle as one of plane Trigonometry, and use it for finding the Csh'sl.na, or quantity of the digits obscured in an Eclipse.—Libitangula; digits referred to the same. Vide p. 352, 313.

- LI LA'VATI' GAN'ITA, (こうこうないこう)—A general term for the science of the mathematics, of which it is said that the best known treatises are those of A'rya bhatta, and Bháscara; which may be correct for this part of India, where few original books on the sciences are to be found.
- LIPTA AND VILIPTA, ( ్రైఫ్స్ పిల్ఫీ)—Measure of time (vide Vicala) equal to one minute and one second.
- LOCAS, (Colored Spheres, imagined to be allotted for the residence of different species of animated beings. The seven superior Lócas are, 1º The Bhu-lóca, or surface of the Farth. 2º Bhuva.

  3º Sivarga. 4º Maha. 5º Jana. 6º Tapa; and 7º Satya lócas.—The inferior Lócas are,
  1º Atala. 2º Vitala. 3º Sutala. 4º Talátala. 5º Mahatala. 6º Rasatala; and 7º Patála lócas.

## M

- MACARA, ( あき ど)—The Hindu Solar Sign Capricornus vg. Vide p. 5, and Table III.
- MADHYA, on MADHYAMA, (మధ్య, మధ్యమ)—Signifies mean, in contradistinction to Sphuta, for true or apparent.—Madhyama graha, or gati, mean place or motion of a Planet; vide p. 1, 83, 86.—
  Madhya ch'háyá, the midday shadow of the Gnomon on any day of the year, excepting those of the Equinoxes. Vide p. 97.
- MA'GHA', (太子故)—Magh, the 10th Hindu Solar month, when the Sun is in the Sign Macara
  ve, answering to the Tamil month Tye; vide p. 5 and Table III.—Maghà, the 10th Lunar
  mansion. Vide p. 74.
- MAHA', or MAHE', (知る)-Great.-Maha yug, a great period of conjunction or opposition.-Mahá
  Indra; the great Indra, &c.
- MAHA'BHA'RATA, (云文文文)—An historical poem of great celebrity; in the first book of which is given an account of the war between the S'uras, and As'uras, in which the gods intervened. This poem is interesting to Astronomy, because it records the first Eclipse of the Sun mentioned in any of the Sastras. Modern European commentators suppose that it was written in the year 780 of the Christian Æra, and that the date of the Eclipse which it records is the 25th October in the year 945 before Christ, and therefore anterior to that transmitted to us from the Chaldeans, which was observed on the 19th March A. A. Christum 720.
- MAHA YUG, (మహేయుx)—A grand period of general conjunction, containing 4320000 Solar Sydereal years, and comprehending the four lesser yugs. Vide Cali, Dwapara, Treta and Satya yugs; also p. 7, 77.
- MALAYALA, (あっかい)—The name given to the lands which extend from Mangalore to Cape Comorin, following the Coast of Malabar. Vide p. 130, 298; of Chr. Tables, p. vi and Table I.
- MALLI CA'RJANADU, (మర్రీకాజుగ్నుడు)—(wrongly spelt in the Text Mulla Carjanada)—A Teluga

Astronomer, who is supposed to have flourished in the 4279th year of the Cali yug (1100 Saca) who like Bálá dityaca referred his computations to the Meridian of Ramiswara. Vide p. 9.

- MANA, (云っる)—Generally a Measure.—In Astronomy a mode of reckoning the duration of the year, whether as Saura, Chandra, Savana, Nacshatra. Varahaspatiya, Brahmya, Dayoya, Pitriya, or Prajaputiya .- The principal mode of reckoning the year as now practised by the Hindus is, either Solar, or Luni-solar, .- The Solar is the time which the Sun takes to perform a complete revolution round the heavens, beginning from a Star and returning to the same. The Solar Hindu year is therefore Sydereal; but it is taken to be of various durations, according to the systems and authorities which are followed. ... The Luni-solar year in most general use, or the common Chandra mana, consists of 12 or 13 Lunar months. It commences with the new Moon at, or next before the time when the Sun enters the first Sign of the Solar Sydereal Ecliptic. Its months are called Muc'hya or primary. The Barhusputya (wrongly spelt in the Text Banu Husputtiah) Chándra mana, is another sort of Luni-solar year, which begins at the wane of, or the full Moon next preceding the Sun's entrance into the Sydereal Ecliptic. Its months are called Gauna, or secondary; vide p. 1, 57, 63, 77, and of Chr. Tables p. ix and Tables I and II.—The Vrihaspati mana, or Jupiter's year, is properly the time during which the Planet describes one Sign of its orbit. However, in the Peninsula of India, it is taken to be equal to the Solar year, and in present times serves only to give a specific name in a cycle of 60 years, to each Solar and Luni-solar year. Vide Third Memoir, p. 197, and Chr. Table I; also Samvatsara.
- MANDA, (5005)—What Europeans call Anomaly.—Manda p'hala, the Anomalistic equation of any Planet.

  —A name of Saturn; vide p. 87, 89, for the Sun and Moon, Tables XXII, XXIV, and XXIII, XXV; for the Planets, IId part of Tables from XLI to XLV.
- MAND'ALA, (ちつざい)—A Circumference, a great Circle.—Nádi mand'ala (spelt Nari in the Text)—The Equator.—Cránti mand'ala, the Ecliptic. Vide p. 5, 91, 342.
- MANDOCHA, (あってない(—The Apses of a Planet's orbit.—Tunga mandocha, the higher Apsis. Vide p. 11, 76, 83, 84, 154.
- MANGAL'A, (知られず)—A name of the Planet Mars.—Mangal'a vara; Tuesday. Vide p. 6, and of the Tables the XLIst.
- MANMATHA, (大うちょな)-The 29th year of the cycle of Jupiter. Vide Chr. Table I.
- MANUS, or MENU, (5050)—Fourteen Patriarchs who are supposed to preside successively over the same number of Manuantaras of which the Calpa is composed, and whose anniversaries are noticed in the Kalendar. Vide p. 311.
- MA'RCANDA', (出ている)—An Astronomer who has left several useful Tables, of a modern date. Vide Pr. p. ix, Text p. 87, Tables XXIV & XXV.

MARGALI, ( Som K = 3)—The 9th Tamil Solar month, answering to the Hindu Paushya, when the Sun is in the Sign Dhanus 1. Vide p. 5, and Table III.

MARGASIRAS, (55 X = \$550)—The 8th Hindu Solar month, answering to the Tamil Cartiga; when the Sun is in the Sign Urischica m.—This month is also sometimes called Agrahayan, a name which was given to it when it was made to begin the Solar year. Vide p. 5, 245, and Table III.

MA'SA, (మτο κ)—(wrongly spelt Masha in the Text)—A month, whether Solar or Lunar, and consequently of various durations.—The first month of the Solar year is called in the Suryah Siddhanta, Mésha músa, because the Sun is then in the Sign Mésha γ, answering to the Hindu month Vaisácha, and Tamil Chitra (always spelt Chaitram in the Text).—It is also the first month of the common Luni-solar year, called Chaitra (whether it opens with the new or full Moon), and therefore, refers to two sorts of Luni-solar years.—The Nacshatra Chandra masa is the time which the Moon takes to move through a Sydercal revolution.—The common Lunar Kalendar month, Do. through a Synodical revolution.—Deva masa, 30 Sydereal years.—Brahma masa, 30 of his days. Vide Mána; also p. 5, 11, 53, 69, 77, and Table III.

MATSYA DE VA, (మత్స్ డేవ)—One of the incarnations of Vishnù as a Fish. Vide p. 311.

MASI, (57%)—The 11th Tamil Solar month; answering to the Hindu Phalguna, when the Sun is in the Sign Cumbh a zz. Vide p. 5, and Table III.

ME'RU, (意め)-Seems to mean strictly the Terrestrial Orb; or yolk of the mundane egg.

ME'SHA, ( & )—The first Sign of the Solar Sydereal Zodiac, the Hindu Aries; vide p. 5, & Table III.—

Mésha Ayaná; the Vernal Equinoctial point (vide Ayaná).

MID'HUNA, (こめいろ)—The 3d Sign of the Hindu Ecliptic II, the Hindu Gemini. Vide p. 5, and Table III. MIHIRA, (22 から)—An epithet of the Sun.

MI'NA, (DJ N)-The 12th Sign of the Ecliptic X, the Hindu Pisces. Vide p. 5, & Table III.

MRIGASI'RAS, on MRIGASI'RSHA, (だっなもど)—The 5th Lunar mansion. Vide p. 74.

MUC'HYA, (知识)—A name given to the Lunar months of the common Chándra mana; meaning primary.

Vide.p. 148.

MU'LA, (太プロ)—The 19th Lunar mansion. Vide p. 71.

MUNI, (SwD)-Supernatural Beings to whom Suryah (the Sun) revealed the science of Astronomy.

MURTA, ( \$\sigma j = )\to -\text{literally}, the twinkling of an eye, -\text{figuratively}, a mode of reckoning small portions of time. The Nacshatra days (all of which are supposed to be equal throughout the year) contains 60 dandas \(\dip \text{60 vicátás} \dip 6 \text{pránácátás} \dip 10 \text{castácátás}, or respirations. The latter answering, therefore, to a second of Hindu time \(\dip 60 \text{ alipalas} \dip 3600 \text{ nimeshas}, &c.\)

N. B. The sexagesimal order is interrupted after the vicátás, which are only subdivided into 6 pránácátás for the purpose of procuring a numerical division of time equal to the number of minutes of a degree contained in the circumference of a Circle, being 21600. Vide p. 6, 92, 104.

N.

NACSPATRA. (N. 75)-Properly a Star: Hence the Sydereal year, month, or day, are called Nacshatra sampaisma, mase, or dina.—But that term means also a Constellation, and still more puriocalarly, any one of the 27 mansions of the Moon; we shall especially consider the latter at article Ricsha. A Lunar mansion contains an arc of 13° 20' of the circumference of the Zodiac (27×13° 20'=360), therefore a Solar Sign contains 24 Nacsharras (3° 20'=360). There are a fixed and a morcuble Lunar, as well as Solar Zodiacs: therefore there are also fixed and moveable Signs, and Nucshatras, the motion of the latter being equal to the progress of the Ayanansa (54" per annum, Suryah Siddhanta). This distinction occasions, the same ambiguity, when Indian authors speak of these Signs and Nacshatras, as there is with us when we say that " Aries has got into Taurus". But they present this justa position of the fixed and moveable Signs, in a manner quite different from ours. They would say that the advance of the Stars from West to East, being owing to the Cranti-Pata-Guti (the Hindu precessional variation), it is the moveable Sign Aries which has receded from the Constellation, or fixed Sign of the same name, with which it formerly coincided; and consequently, that the Zodiacal Sign Aries has fallen back into the fixed Sign Pisces, which comes precisely to the same thing. But more scientifically, they would say that the Rishis have got into some point of the moveable Arics; (vide Rishis, Ayanansa, Cranti-Pata-Gati.)—It needs hardly be added, that what is said here of the Solar Signs applies equally to the Nacshatras .- For the extraordinary Nacshatra, see Abhijit; vide p. 6, 73, 74, 176, 181, and Table XXXVIII.—Nacshatra Chacra; the Sphere of the fixed Stars.

NA'D'IMAND'ALA, (おたは)のほと)—(written in the Text Narimandala)—The Celestial Equator. Vide p, 5, 91.

NA'GAVA, (あんだ)—The 10th and extraordinary Carana. Vide p. 75.

NANDANA, (ろodみ)—The 26th year of Jupiter's cycle. Vide Chr. Table I.

NARA', (あび)—The eternal omnipotent Being.

NARA'DIYA, (నారదీయ్య్)—The name of an Astronomical work composed by Narada.

NARA'SIMHA, (నరసంహా)—The 4th incarnation of Vishnu as a Lion. Vide p. 311.

NATRATIANIA, (నారాయణ)—A name or incarnation of Vishnu.

NATA (No. 1)-The arc of distance of any Planet from the Zenith.—Natáns'a or Náta bhaga, Zenith distance. Vide p. 91, 96.

NAVAMI, (るまな)-The 9th Lunar day of the Pacsha. Vide p. 70.

NAZIII, on NA'SIIICAY, (Επιμί, ποτιμίσος)—A Tamil term meaning an Indian hour of time. Vide p. 71. NELA, (Ξυ)—In Telugu, a month.

NERMADA, on NARMADA, (ठठ ळ॰)—A great River called in our Maps the Nerbudda, which from time immemorial has marked the boundary between Hindustan and the Deckan. It takes its source

near the Vindha mountain in the Province of Malwa and flows into the Sea near Surat. This river is the same as that which Ptolemy calls Namadus. The Indian name is a compound Sanscrit word, which signifies the river of delight; from Nerma, pleasure, and Da, she who bestows. Independently of the use made of this river in Geography, it serves also to separate two sects of Astronomers, who divide time on different principles. Thus whereas the Vrihaspati or Jupiter's year of the cycle of sixty, is reckoned at Oogein and Benares, and down to the Nerbudda, to be equal to the time during which that Planet describes one Sign of its orbit, in all the Deckan, down to Cape Comorin, it is taken to be equal to a Solar year. And whilst all the Northern Astronomers reckon the latter to be of 365d 6h 12' 34", agreeably to the doctrines of the Suryah Siddhanta, those who reside South of the Nerbudda make it only 365d 6h 12' 30": from this class, however, we must except that subdivision called the Sittandij, or inhabitants of the Southernmost part of the Peninsula, whose year differs only one second of time in minus, from that of the Northern Astronomers. Vide Pr. p. ix; Text, p. 7; the IIId Memoir from p. 199 to 216, and Chr. Table I.

- NIJA, (SE)—Proper, self.—Nija Aswina, the proper month of Aswina, in contradistinction of Athica Aswina, the intercalated Lunar month. Vide p. 69, 72, 146, 342.
- NIMESHA, (のま) な)—The 1-3600th of an Alipala (vide Alipala), or the time for the twinkling of an eye. Vide p. 6.
- NIRACSHA, (Notes)—The Terrestrial Equator.—Niracsha désa, the Equatorial parts of the Earth.—Niracsha-pura, the four fabulous cities supposed to lie under the Equator, of which Lanca is one. (Vide Lanca).

0

For Opady, thus wrongly written in the Text, see Uphadi.

I

- PACSHA, (SS)—Half the Lunar month.—Sucla or Sudha pacsha, the time from the new to the full Moon.—Crishna or Bahula pacsha, that from the full to the new Moon.—Each Pacsha, whatever be the real duration of the Lunar month, contains 15 Tithis, or Lunar days, each being called numerically, so that there are two Tithis of the same name in the Lunar month. Vide p. 68, 69, 314, 318.
- PA'DA', (are E)—The fourth part.—The Quadrant of a Circle.—The Púdás of the Ayanáns'a; the four Quadrants of the Epicycle, or parts of the Arc described by the 1st point of the Tropical Zodiac in consequence of the precessional variation. Vide p. 84, 247, 248, 308, 313, and Tables XXXV and XXXVI, p. 46 and 47 of the Tables.
- PA'DACHA'RUM, or CHA'RUM, (かなむ)—(sometimes wrongly spelt in the Text Isharum)—A term

used in the Kalendar and Ephemerides for signifying the position of the Planets on a particular day; heing one of the five articles of the Panchanga. Vide p. 73, 75, 308.

PAD'YAMI, (かばんな)-The 1st day of the Lunar pacsha, or demi.month. Vide p. 70.

PALA. (Ze)\_A minute of time, Hindu account.

PALABHA, (పలఫ)-The midday Shadow of a Gnomon, when the Sun is in the Equinoctial points. Vide p. 9, 94, and Table XXXIV, p. 45 of the Tables.

PANCHA BHUTA, (あのなめつる)—The five elements of Nature, including Ether.

PANCHA'NGA, (SCOTOX) -- A Kalendar so called from the five principal articles contained in the Ephemerides.

PARA, (など)-A second of time, Hindu account, or 24" European time.

FARA'BHAVA, a てつなる)\_The 40th year of the cycle of Jupiter. Vide Chr. Table I.

PARA BRAHMA, (పర ట్ర స్ట్రా)—A name, or epithet of the Supreme Being.

- PARAMA'PAMA, ( 55 5 55)—The inclination of a Planet's orbit to the Ecliptic.—Paramópama cramajya, the Sign of its greatest Declination.—N. B. When this term is applied to the Sun, because according to Hindu theories the obliquity of the Ecliptic is always 24°, it means the Sine of the Sun's greatest declination.
- PARA'S'ARA, (& 50° 8° 8)—An Astronomer who wrote when the Equinoctial points were in 23° 20' of the Sign Mesha.—Modern commentators pretend that the Parása'ra Siddhánta is a spurious treatise, written by Arya bhatta, so late as the beginning of the XIVth century; and consequently cannot have been written by Parás'ara, who flourished about the year 575 before Christ.
- PARAS'URA'MA, (&&& & or osci)—One of the Avataras or incarnations of Vishnù, in the form of a Brahmin.—
  Modern commentators fix his epoch in the year 1176 before Christ. He is said to have been a great encourager of Astronomy.—Also an Æra which is still followed in Malayálá (that part of the Coast of Malabar which extends from Mangalore to Cape Comorin).—This Æra is reckoned in cycles of 1000 years; each of which begins on the Sun's entrance in the Sign Canya my (Indian Virgo).—There were, therefore, on the 14th September 1800, two cycles, and 976 years of that Æra expired. Vide p. 298, 302, and of Chr. Tables p. vi, vii, & Table I.
- PARIDHAVI, or PARIDHA'PI, (పరిధాపి)...The 46th year of the cycle of Jupiter. Vide Chr. Table I.
- PARIDHI, (50%)—Properly means the circumference of a Circle; but it is more generally used in the sense of an Epicycle. Thus Paridhi an's ús, or bhagas, mean degrees counted on an Epicycle, always in a given ratio, to those of the Deferent.—The Manda paridhi, is used for computing the first inequality or Anomalistic equation of a Planet. It is variable, being called Yugma

paridhi in the Apsides, and Voja paridhi at 90° therefrom.—The degrees of these divers dimensions of the Epicycle vary therefore relatively to those of the Deferent, as the Planct's Anomaly is between the points above mentioned, decreasing inversely as the Sines of the mean Anomaly. At the distance of 3 Signs from either the Apogee or Perigee, the radius of the Epicycle becomes equal either to the eccentricity; or to the Sine of the elongation, if it refers to an inferior Planet.—This assumed difference in the magnitude of the Epicycle, (and consequently of its degrees relatively to those of the Deferent) is what the Hindus call Paridhi an'sá, between Vishama, and Sama (odd or even); for a right application of which we are to remember that from the 1st to the 3d Sign of Anomaly, a Planet is in Vishama; from the 3d to the 6th, it is in Sama; from the 6th to the 9th, it is again in Vishama; and lastly, from the 9th to the 12th, it is in Sama.—The Sighra paridhi is used for computing the second inequality, answering to the annual Parallax of the superior Planets, and elongation of the inferior ones. This Epicycle is also variable, being called Yugmantara paridhi in the Sizigies, and Vojantara paridhi at 90° therefrom.—Swa, Seva, or Siva-desa-paridhi, a Circle of Longitude in any given Latitude. Vide p. 91, 95, and Table XXXIV.

PARIGHA, (50%)—The Yoga Star of the 19th Lunar mansion. Uncertain; but supposed to be 34 or 35 Scorpii. Vide p. 74.

\* PA'RIJA'TA', (ਨਾਰਿਲਾਰ)—The Tree of Plenty.—In some parts it is taken to be an emblem of the year; but this is unknown to the Pundits of the Carnatic.

PA'RTHIVA, (つゆきる)—The 19th year of Jupiter's cycle. Vide Chr. Table I.

PASCHA, or PASCHAMA, (ప్రశ్నేమ)—The West point of the compass.

PATA, (30) The Node of a Planet's orbit. Vide Ayanansa and Dhruva, also p. 86.

PATACA, (なざき)-An Astronomical Table.

٠.,

PATANA, (あるろ)-Latitude, when referred to the Planets.

PATRA, (5)—Literally, a Leaf; but used in several parts of India for Panchanga, a Kalendar; because these are usually published on Palmyra leaves. Vide Pr. p. vii, xii, and Text p. 312.

PAU'LASTYA SIDDHA'NTA—(పాల్స్ట్రోస్ట్ స్ట్రాంక)—The third of the four authentic Sústras, which treat of Astronomy.

PAUSIIYA, (300 5)—The 9th Solar Hindu month, when the Sun is in the Sign Dhanus 1, answering to the Tamil Margali; vide p. 5 and Table III.—Paushya is also the 10th month of the Luni-solar year, so advanced by one in the order, on account of Chaitra, beginning that sort of year. Vide p. 69.

PAVARNAMI, on PURNIMA, (おっちゃ 20)—The 15th Lunar day of the Pacsha. Vide p. 70.

P'HALA, ( c)—An Equation.—When applied specially to the Sun or Planets, it means their Anomalistic equation.—P'hala try desentara, is a compound equation used by the Tamil Kalendar makers for

computing, by means of certain Tables, and a short operation, the Arcá bahuphala, and the effects of difference of Longitude in Solar and Lunar computations. Vide p. 38, 230, 338, and Tables XXII to XXVI for the Sun and Moon, and from XLI to XLV, part 2, for the Planets.

PHALGUNA, AND PHALGUNI, ( Peropero)—Phalguna the 11th Hindu Solar month, when the Sun is in the Sign Cumbh'a :: answering to the Tamil Maussi; vide p. 5, and Table III.—According to the Luni-solar Kalendar Phalguna is the 12th month of the year, because it begins with Chaitra; vide p. 69.—Purva Phalguni the 11th, and Uttara Phalguni the 12th Lunar mausions. Vide p. 74.

PINDA' (3) 0 3)—The 1-24th part of the Quadrant of a Circle; equal to 3° 45', the constant ratio of the Hindu Trigonometrical Tables. Vide p. 87 and Table XXX.

FINGALA, (ぬのんな)-The 51st year of the cycle of Jupiter. Vide Chr. Table I.

PITRI, (& 5)—Certain Genii or Spirits, supposed to reside in a sphere or region, some say above the Moon; others residing in it. The Pitris are also taken to be the spirits of deceased ancestors.—Pitrya dina; a day of the Pitris equal to a lunation.

PLAVA, (ప్రవ)--The 35th year of the cycle of Jupiter. Vide Chr. Table I.

PLAVANGA, (変あのX)—The 41st of the same.

PUNGONI, (おうなら)\_The 12th Tamil Solar month, answering to the Hindu Chitra, when the Sun is in the Sign Mina 光. Vide p. 5, and Table III.

PRABHAVA, (ప్రభవ)--The 1st year of the cycle of Jupiter. Vide Chr. Table I.

PRAC CHACRA ( ) The Epicycle on which ancient Astronomers corrected the precessional variation. Vide Cranti-Pata-Gati, and p. 84 of the Text.

PRA'JA'PATI, ( ప్రహెష్ట్)—A name of Brahma.—An epithet common to 10 divine personages who were first created by Brahma.—Pra'ja'pati; the 5th year of the cycle of Jupiter; vide Chr. Table I.—
Praja'patya ma'na, a certain mode of reckoning the year; also, a Manwantara.

PRAL'AYA, or JALA-PRALAYA, (あずめ)—A name for the universal deluge.

PRAMADI OR PRAMADICHA, (ప్రమాదీచ)—The 47th year of the cycle of Jupiter. Vide Chr. Table I.

PRAMAN'A', ( ) and prama'n'a, the Sun's revolutions from the horizon to the same again.—Dina prama'n'a, the time of any Planet from rising to setting.—

Rutri prama'na', the same from setting to rising.

PRAMODA, ( ある)—The 4th year of the cycle of Jupiter. Vide Chr. Table I.

PRAMAT'HI, (ప్రమాద్)\_The 13th of the same.

PRA'NA'CA'LA, ( 💸 🎞 )—The 1.6th part of a vicala. See Múrta, and p. 5, 77, 104.

PRATHAMA, ( ) 4 5 )—The first.—Prathama tithi, the first Tithi or Lunar day in the month; that which always follows the day of last conjunction; vide p. 70, 79, 103, 112, 137, 172, 229.—Prathama chara, Ascensional difference of the 1st Sign of the Hindu Tropical Zodiac; vide p. 103.—The same for the Sun's declination and Amplitude; vide p. 102, 103.—Prathama jiva, the Sine of the first Pinda. Vide p. 39 of the Tables.

PRI'TI, (3,3)-The Yoga of the 2d Lunar mansion, supposed 35 Arietis. Vide p. 74.

PUNARVASU, (ఫ్రవర్గాను) - The 7th Lunar mansion. Vide p. 74.

PANCHAMI, (るのなる)—The 5th Lunar day of the month. Vide p. 70.

\* PURANA'S, (& 500)—Books held in high veneration by the Hindus, treating of Theology, Literature and Astronomy, and other matters, of which there are 18 principal ones: they take these productions, as usual, to be of the highest antiquity; but modern European commentators have been very active and industrious in their endeavours to bring down the epochs of their respective compositions nearer to our times. Many of the Puranás are now believed to be very recent, and one of them in particular is conjectured not to be above 100 years old.

PU'RNIMA', (50 5 5 50) Opposition (sometimes written Paurnimá) Púrnima tithi, the day of opposition or full Moon. Vide p. 67, 70, 313, 320, 339.

PURVA, (55 )—When referred to one of the Lunar mansions means the First, and in the same manner as Uttara, means the Second. Vide p. 74.

PURU, (など)—The East point of the compass.

PUSHYA, Sas 1-The 8th Lunar mansion, vide p. 74, where the word is sometimes wrongly spelt Pushia.

R.

RA'C'SHASA, (でべる)—The 49th year of Jupiter's cycle. Vide Chr. Table I.

RACTACSHA, (とうじ)—The 58th of the same.

RAGINI'S, (つつうる)\_Spirits, or demi-goddesses personifying the notes of music.

- RA'HU, (The Moon's ascending Node.—In a physical sense the Hindus consider it as one of the obscure Planets, which occasion Eclipses: but according to mythology, Ru'hu is the head of a monster, of which Cétu (the descending Node, spelt Ketu in the Text) is the trunk.—It is supposed by some commentators to be the Typhæus of Hesiod. Vide the war of the Súras and Asúras in the Mahábhárata), also p. 77, 308, 310, 340.
- RA'MA', (Toba)—The principal of the Avatu'ras, or descents of Vishnù; a great conqueror, and the Prince whose reign forms the most important epoch of Indian history.—Sir William Jones places the subjugation of India by Ra'ma' about the year 1810 before Christ. Mr. Bentley, after a much more accurate research, fixes his birth on the 6th April of the year 961 before Christ. In his time and that of his father Das'uratha, Astronomy was much cultivated; and it is supposed (not without much probability) that the first Astronomical Tables for computing the places of the Planets were constructed on the observations made in Ra'ma''s time. There was an Eclipse of the Sun on the 2d of July of the year 940 before Christ, which, according to Mr. Bentley, may be referred to with certainty, as an epoch of Rámá's reign.

RA'MA'YANA, (であずる)—(of Válmíci)—An historical poem, being one of the principal ones (viz.

the Rámáyana, the Bhágavata, and the Mahá'bha'rata) which have been transmitted to posterity. It gives an account of the epochs of the sway, and dynasties of Princes; of the wars and battles (true or fictitious) which have been fought during their time, and of the heroes who have shed a lustre over their reigns; of the revolutions which the country has undergone; and of the origin and progress of the sciences in the infancy of time.—Modern European commentators fix the epoch in which the Ra'ma'yana was written in A. D. 295; professing however, their belief that the events which it records are of much higher antiquity.—In the Ra'ma'yana, Valmíci is repeatedly mentioned as the name of its author.

- RAMI'SWARA, or RAMA-ISWARA, (To So So )—(written in the Text Ramissuram, and Ram-Ishu-ra)—Is a small island, situated between Ceylon and the Continent of India, at the entrance of Palk's passage in the Streights of Manaar; where there stands a very ancient Pagoda, and formerly an Observatory.—It was found by Colonel Lambton's survey to lie in 79° 22′ 5″ (5h 17′ 28″ 20″) Longitude of Greenwich; in 77° 1′ 50″ (5h 8′ 7″ 30″) East of Paris, and consequently in 3° 28′ 50″ (14′ 55″ 20″) East of Lanca: its Latitude being 9° 18′ 7″ N.—Many Telegu, and Tamil Astronomers, as Báládityacalu, and Mallicárjanad'u refer their computations to the Meridian of Rámiswara. Vide p. 9, and Tables XXXIII and XXXIV.
- RASA GIRICA, (どんちょ)—(written in the Text Raza Gherica)—An element of the Vac'yam process, containing 13,372 days. Vide p. 122, 132, 133, 235.
- RA'S'I, (5°3)—A Sign of the Zodiac, containing 30 degrees.—Modern European commentators state that the Stars were only formed into Constellations during, or at the epoch of the war of the Sura's and Asâras, which, according to them, refers to the middle of the VIIIth century before Christ.—A Râs'i is equal to  $2\frac{1}{4}$  Nacshatras or Lunar mansions.—The Hindu Signs are called by specific names when reckoned on the Sydereal Zodiac; but when counted on the Tropical, or moveable Sphere, they are called numerically. The figurative description of the Hindu Signs with the corresponding Lunar mansions, are as follows:
  - 1, Aswini, Ram  $\gamma$ ; 2, Criticà, Bull &; 3, Mrigasirsha, Pair II; 4, Pushya, Crub  $\varpi$ ; 5, Asléshà, Lion  $\Omega$ ; 6, Uttara Phalguni, Woman m; 7, Swati, Balance  $\alpha$ ; 8, Anúrádhà, Scorpion m; 9, Múla, Bow  $\beta$ ; 10, Uttara Ashadha, Sea Monster  $\gamma$ ; 11, Dhanishtha, Ewer  $\alpha$ ; 12, Purva Bhadrapada, Fish  $\beta$ .—Ras'i Chacra, the Zodiac. Vide p. 5.
- RATRI, ( The night.—Ratri ardha; half the artificial night. Vide p. 92, 106.—Tyajya Ratri, (vide Tyajya Devi).
- RAVI, (82)—A name of the Sun.—Ravi vara, Sunday; vide p. 6, and Tables XX, XXII, XXIV, XXVII, XXVII, XXVIII, and XLVII.—Ravi mandocha, Sun's Apogee, p. 83; Ravi madhya graha, mean place in the Sydereal Ecliptic, p. 83; Ravi panchanga, the Solar Kalendar, p. 63, 307, 313; Ravi p'hala, Anomalistic Equation, p. 128; Sayana, Longitude, p. 101.
- RAUCHYA, (Bussel)—One of the 14 Patriarchs who are supposed to preside successively over the 14 Manawaras of the Calpa, and whose anniversaries are noticed in the Kalendar. Vide p. 311.

RAUDRA, (30 (2))—The 54th year of the cycle of Jupiter. Vide Chr. Table I.

RAYAVATA, ( 553)—One of the 14 Patriarchs who are supposed to preside over the 14 Manifantaras of the Calp 1, and whose anniversaries are noticed in the Kalendar. Vide p. 311.

RECHA, (52)—Meridian.—Used in the same sense as Europeans do when referred to the Longitude. Vide p. 9, and Table XXXIII.

REVATI, (839)-The 27th Lunar mansion. Vide p. 19, 74.

Maha-Ricsha may therefore be understood either as the constellation of the Bear; or as the great constellation. Whether the former denomination (which is the same as the name given by Europeans to the asterism called the Great Bear) be merely accidental; or whether by that term, both Europeans and Hindus, mean the same object, is a question which is not to be resolved in this place. In Tetingana it is affirmed that it does; in the Carnatic it is defied; we have therefore only to observe that as the Great Bear is the most prominent constellation of the Northern hemisphere, it may very well (and without any reference to the animal of which it bears the name) be concluded that Maha Ricsha means the same object both in European and in Indian Astronomy. Vide p. 85, 245.

RINA, (? ) The Indian Sign of negation, or subtraction, which answers to the European - minus.

RISHI (2000 a)-An important term in Hindu Astronomy, which, in its scientific sense, means a line, or great circle, passing through the Poles of the Ecliptic, and the beginning of the first Solar Sydereal Sign, and first fixed Lunar mansion, of the respective Zodiacs; and which said circle is supposed to cut some of the Stars in the Great Bear, which most commentators take to be Dhube, or & Ursæ Majoris, and & Piscium, although in reality no such circle could be made to intersect exactly these three points. This line, or circle, being thus invariably fixed, and the four (fixed and moveable) Zodiacs being conceived to coincide at a particular Epoch, the variation of the moveable ones may easily be reckened by its means, as if it were an index. Thus suppose that the line of the Rishis should have intersected the beginning of the fixed Lunar mansion Magha, as was supposed to be the case in the 1910th year of the Cali yug (1192 before Christ), and that at the beginning of the said year the line of the Rishis was found by observation to intersect the middle of the moveable mansion Magha, then it would be said truly that the Rishis had got into 6° 40' ( $\frac{13^{\circ}}{2}$  of the moveable Magha, and these 6° 40' would mark the absolute precessional variation which had accumulated at that epoch since the time that the fixed and moveable Maghas coincided; (vide Ayana, Ayanansa, Cranti-Patu-Gati) .- The above explanation of the term Rishi is clearly justified by all the Hindu treatises of any weight which have hitherto fallen into the hands of Europeans; and here it may not be out of the purpose to observe, that when Hipparchus (later than the 135th year before Christ) on comparing his observations of Spica Virginis (the Harshana of the

Indians) with those that Timocharis had made at Alexandria about a century before, and perceived by the results, that the Stars appeared to have advanced (though slowly) from West to East, relatively to the Equinoctial points, he was far from imagining that Indian Astronomers Operhaps several centuries before his time, and in all probability by observations of the same Star) had already noticed the same variation, on which in after ages Sir Isaac Newton resolved and established the great problem of the Equinoctial precession .... The celebrated Indian Astronomer A'rya bhatta, probably puzzled how to account for the change of the position of the line of the Rishis which, he admitted, had intersected the middle of the moveable Lunar mansion Magha in the year of the Cali yug 1910, and which he pretended to cut (when he wrote) the beginning of Aswini, imagined a curious system on the seven Stars of the Great Bear, to which he supposed a proper motion to the Eastward, at the rate of 13° 20' (a Lunar mansion) in 100 years; which amounted to 159909 revolutions in a Calpa, and which squared his account. But this absurd doctrine has long since been abandoned by all manner of Indian Astronomers; many of whom, now in existence, have never heard of it.—The term Richi is also applied (in a sense totally definent) to the Van'aprastha Brahmins, or inhabitants of the desart. Of these the most ancient and celebrated were the seven great Rishis or penitents, who had refired in the territory washed by the Indus; and it was to them, it is supposed, that Alexander the great applied for instruction after invading their country. Vide p. 85, 245.

RITU, (2005)—A season, of which there are six of two months each in the Solar year, (vide Vasanta, Grishama, Varsha, Sarada, Hemanta and Sisira.) Vide p. 4.

RO'HINI', (8 ちゃん) \_The 4th Lunar mansion. Vide p. 74.

ROHITACA, (でかざる) \_\_A mountain or place lying under the Meridian of Lanca.

ROMACA, (స్టోమక)—One of the four imaginary cities lying under the Equator. Vide Lanca.

RUDIRO'DGARI, (必まがる)—The 57th year of Jupiter's cycle. Vide Chr. Table I.

RUDRA SAVARNI,—(んとうざん)—(The same explanation as for Rauchya). Vide p. 311.

RUG, RUC, on RIG VEDA, (2005, 2007) S—The first of the inspired Vedas. Rig, signifying the science of distinction, of which it principally treats. It also teaches Astronomy, Astrology, Natural Philosophy, and gives a particular account of the formation of matter, and the creation of the world.

RUPA, (X - 2) - An entire number.

Ç

SA'CA, (ぞざ)—An epithet given to a Prince to whose name posterity refers an Æra. (Vide Salivahana). SA'CHA, (でつれ)—Department; branch of knowledge.

SADHA'RANA, (ਨਾਫ਼ਾਰ &)—The 44th year of Jupiter's cycle. Vide Chr. Table I.

SA'DHYA, ( \$\$\times \S)-The Yoga Star of the 22d Lunar mansion, a Aquila, Vide p. 74.

S'A'LIVA'HANA, (3.2)—The name of a Prince who is said to have reigned in a country called Magadha.—He instituted, or was the cause of the institution of an Æra, which bears his name, the beginning of which is referred to the epoch of his birth. This event is supposed to have taken place when 3179 years of the Cali-yug had expired, which makes it fall 78 years after the beginning of the Christian Æra.—The Saca year is the same as, and begins with, the common Solar year. Vide p. 18, 203, 222, 228, 293, 296, 302, 303, and of Chr. Table p. vi, Table 1.

S'A'LMALA, (v) e) An island lying East of Lanca, supposed to be Ceylon.

SAMA AND VISHAMA, (సమ, విషమ)—Literally even and odd (vide Paridhi, and Paridhi ansa).—Sama mand ala ch'háyá, the Shadow of a Guomon when the Sun is East or West of it. Vide p. 97.

SAMA'GAMA, (సమాగమ)—The occultation of a Star.

SAMARGA, (సమామ్)—A term used in the Kalendar to denote a middle state of abundance; neither favourable nor unfavourable to the productions of the Earth. Vide p. 312, 313.

SAMVATSARA, (おっぱあん) —A year: chiefly applied to the Luni-solar year. Vide Mana; also p. 71, 77, 153.

SA'MA VE'DA, (సామవ్ద)—The 3d of the inspired Vedus. This book treats of all religious and moral duties: It also contains many hymns in praise of the Supreme Being, as well as verse in honor of the geds.

SANCRA'NTI, (だってこ)00)—The day on which the Sun enters a new Sign of the Ecliptic.

SA'NCU, (YON)-A Gnomon for Astronomical purposes. The Pillars which are erected in front of every Pagoda are real Gnomons. Vide p. 91, 92, and Table XXXIV.

SANDHI, or SANDHYA, (元文, 元文文)—The Twilight or Crepuscule. The Sandhy of Brahma consists of 1728000 Solar Sydereal years; the same duration as the Crita, or Satya-yug, which quantity is used in its double capacity for constructing the Calpa.—Prátas sandhya, the morning twilight.—Sáyam sandhya, the evening do.—N. B. The twilight of each yug is equal to 1-6th part of the same. Vide p. 78.

SANCHYA' GAN'ITA, (XO2) XX 825)—Algebra (vide Katapayadi).

SANGAMA, (సంగమ)—Conjunction. (Vide Arcéndu sangama.)

SANHITA, (సంహారా)-A treatise on any branch of knowledge.

SANI, (\$3)-A name of Saturn: the most common of all; vide p. 6, 189.-Sani-vara, Saturday.

SANIHITA SARAH, (あっかっと)—One of the ancient cities which are stated in books on Hindu astronomy, to lie under the same meridian with Lanca and Ujani. Vide p. 9.

S'ARADA, (To 5)—The 4th season, comprehending the months of Aswina and Carticoy, when the Sun is in the Signs Canya m and Tula =; answering to the Tamil months Paratasi and Arpesi. Vide p. 4.

SARVADHA'RI, (おどらかる)—The 22d year of Jupiter's cycle. Vide Chr. Table I.

- SARVAJIT, (నర్వ 2 🐔)-The 21st year of Jupiter's cycle.-Vide Chr. Table I.
- SARVARI, (でという)—The 34th of the same.
- SA'STRA, (The inspired, or revealed book: this term is also applied to works of literature and science in general. Those which treat particularly of astronomy, are distinguished by the additional name of Jyótish.
- S'A'STRI, A Pundit, one skilled in the Sastras.—N. B. This word is always wrongly written Sastras in the Text.
- S'ATABHISHA, (Y 52) 3)-The 24th Lunar mansion. Vide p. 74.
- SATYA YUG, (\*ios sunx)—The same as the Crita yug. The golden age of the Hindus; the first period of the four contained in a Maha yug. Its duration is of 1728000 Solar Sydereal years. Vide p. 7, 77, 78.
- SA'VANA (BHU'MI), (おっちろ)—Natural—which refers to the Earth (written Savan in the Text). Vide p. 79, 80, 81, and article Savana dina.
- SA'VARNI, (3-58)-An epithet, or cognomen, annexed to the names of five of the Patriarchs who preside over the 14 Manwantaras of the Calpa. Vide p. 311.
- SAUBHA'GYA, (記句本人)—The Yoga Star of the 4th Lunar mansion. Uncertain; but may be 87 Tauri. Vide p. 74.
- SAUMYA, (たっぱら)—The 4th year of Jupiter's cycle. Vide Chr. Table I.
- SAURA, (おうざ)\_Sydereal. Vide p. 1, 5, 77, 202, and article Mana.
- SA'YANA, (3055)—The Longitude of a Planet reckoned from the Vernal Equinoctial point, as is the practice of European Astronomers. This element depends on the Cranti-Pata-Gati, and is calculated by means of the Ayanansa, which latter element being added to the Planet's Sphuta graha (its apparent place in the Hindu Sydereal Zodiac) gives its Sayana, or apparent Longitude. For a fuller explanation of this term see the two articles above referred to, and p. 74, 91, 104, 130.
- \* SEPTAMI, (సమమ)—This term when affixed to the name of one of the Signs of the Zodiac, indicates the day on which the Sun enters the same. Thus Macara septami means the day on which the Sun enters the Sign Macara v9: it is little known to the Pundits of the Carnatic.
- SEVA, on SIVA.DESA PARIDHI, ( ) The Circumference of a Circle of Longitude in any point on the Globe of the Earth, removed from the Equator; or, as Europeans would say, which has Latitude.—The degrees of these small circles of the Sphere are taken by the Hindus to be in the direct ratio of the cosines of the Latitudes; and resolved into assignable quantities from the dimensions of the Equatorial circle, which they take to contain 5059 yojanas; vide p. 91, 95, Table XXXIV, and article Yojana.—Seva desa madhya paridhi; the circumference of the Terrestrial Equator.—Seva desa wydia, a term, (it seems obsolete) for the oblique ascension of a Pianet; (vide Ullagna).—N. B. This element is important in the resolution of all Gnomonic Problems; and for fixing the Longitude of places. Vide article S of the Second Memcir, p. 90.

- SIDDHA, (% 5)-The Yoga Star of the 21st Lunar mansion. Uncertain; perhaps \$\Phi\$ Sagittarii. Vide p. 74.
- SIDDHI (or ASRIJ) (% (2))—The Yoga Star of the 16th Lunar mansion; perhaps 24 Libra. Vide p. 74.
- SIDDHANTA', (% 5005)—literally signifying Demonstrated, established truth; also a conclusion. In Astronomy; a treatise on that science. There is a numerous train of treatises of this kind, of which four only are reputed to be of divine origin, viz.: 10 The Suraya; 20 The Brahma; 30 The Paulastyu; 40 The Soma Siddhantas.—Parására; Varáha, and his son; Bháscara and others have left Siddhántas and Ticas, which are now in repute. But doubts have arisen whether the Parására Siddhanta which exists, be a legitimate or spurious production. Mr. Bentley decides for the latter and believes it to have been forged by A'rya bhatta.
- SIDDHAPURY, (సిద్ధుల్లో)—One of the imaginary cities which are supposed to lie under the Equator at 90° from each other. (Vide Lanca).
- SIDHARTI, கஞ்சு)—The 53d year of Jupiter's cycle. Vide Chr. Table I.
- SI'GHRA, ( & 50)—Answering to what European Astronomers call Parallax; (vide Chaturtha p'hala, and Virdhamanda p'hala).—Sighra chaturtha, the same as the last.
- SINHA, (సంహ)—The Hindu Solar Sign Leo A.
- ·SISTRA, (&88)—The 6th season of the year, comprehending the Hindu Solar months Mágha and Phalguna, when the Sun is in the Signs Mucara vp, and Cumb'ha m, answering to the Tamil months Tye and Maussi.
- SITTANDIJ, (윤주 다양)...A term used by Father Beschi to designate a certain sect of Astronomers who reside in the Southern parts of the Peninsula. It is unknown to the Madras Pundits.
- SIVA, (% 5)—The third person of the Hindu triad, and the principal personification of time. The forms and names which this godhead assumes are without end, and therefore shall be passed over.—Siva is also the Yoga Star of the 20th Lunar mansion and supposed to be the same as & Sagittarii. Vide p. 74.
- S'LO'CA, (5 %)—A verse: a memorial couplet: also a technical rule for computing certain astronomical problems, delivered in verse in the Suryah Siddhanta.
- EO BHANA, (5° 25 8)—The Yoga Star of the 5th Luuar mansion. Very uncertain; but may be 113, 116, or 117 Tauri; vide p. 74.—Sobhana means also the 37th year of Jupiter's cycle. Vide Chr. Table I.
- S'ODHYA, (5 C)—called SOBHACRITU in the Carnatic, (5 S) (wrongly written Sodhyum in the Text)—A constant number to be subtracted in certain computations, to fit the rule to a particular epoch, being the negative of Cshépu, which see. Vide p. 54, 65, 81, 119, 240.
- -SOMA, (からい)-A name of the Moon .- Soma vara, Monday. Vide p. 6.
- \*SPHUTA, (xond)—(wrongly spelt in the Text Spula).-True, or apparent; in contradistinction of Madhyama,

- or mean. Sphuta ravi, or Chandra graha, or gati, true or apparent place or motion of the Sun and Moon, in the Sydereal Zodiac. Vide the whole context of the second Memoir.
- SPRIC, ron SPROHU, ( ) [ (wrongly written in the Text Sprohu or Sprohoo) A Lunar intercalary day repeated during two successive Solar days in the Kalender.
- SRA VANA, ( ) The fourth month of the Hindu Solar year, when the Sun is in the Sign Carcatáca &, answering to the Tamil Andi; vide p. 5, and Table III.—Also the 5th month of the Luni-solar year, owing to that sort of year beginning with Chaitra; vide p. 69.—Srávana, the 22d Lunar mansion. Vide p. 71.
- SNI', (3)—The Venus Aphroditus of the Indians, born like the Grecian Venus from the Sea. (See Lacshmi, and Crishna).—Sri-Crishna is the 9th, and Sri-Rama the 7th incarnations of Vishna, as a Cshetria, and a Dwaif Brahmin, the anniversaries of which are observed. Vide p. 311.
- SRI'MUC'HA, ( & swap) The 7th year of Jupiter's cycle. Vide Chr. Table I.
- 'STIHTYAR'DHA, (ならなき)—The time from the beginning of an Eclipse to its middle.
- STIHRA, ( & ) -A general term for the 4 extraordinary Caranas. Vide Carana, and p. 75.

STHU'LA, (స్టూల)=(Vide Márta.)

SU'BIIA, (Ty)-The Yoga Star of the 23d Lunar mansion, a Delphini. Vide p. 74.

SUBILACRIT, (For 5)—The 36th year of Jupiter's cycle. Vide Chr. Table I.

SUBHANU, (సుఫాను)—The 17th of the same.

SUCARMA, (Κυδή)—The Yoga Star of the 7th Lunar mansion, β Geminorum. Vide p. 74.

- S'UCLA, or SUDHA, (స్ట్ర్స్ స్ట్ర్డ్).—The 1st or enlightened half of the Lunar month.—The 3d year of Juriter's cycle. Vide Chr. Table I.
- SU'C'HI, (సూచ)—The Earth's disc in computing Eclipses.—The fourth term of a proportion, which is to the Moon's equated motion, as the diameter of the Earth, is to her mean motion. This proportion serves in the computation of Lunar Eclipses, to adapt the Earth's shadow, to the Moon's distance and apparent diameter.
- S'UCRA, (5)—One of the names of the Planet Venus.—S'ucra-vara, Friday.—S'ucra or Subra, the Yoga Star of the 21th Lunar mansion, perhaps a Aquarii. Vide p. 74 and Table XLIV.
- S'UDDHA COTI', ( ) C S S 6 2 )—One of the sides of a right angled Triangle; the second being sometimes called Bhuja, and the hypothenuse Carna. Vide p. 91, 94.

S'UDDHA DINA, ( ) (wrongly spelt Soota dina in the Text)—The day on which a particular phoenomenon is to occur. Vide p. 8, 79, 81, 83, 243, 244, and Tables XLVIII and XLIX.

SU'LA, (మాల)—The Yoga Star of the 9th Lunar mansion. Uncertain; perhaps 49 or 50 Cancri. Vide p. 74. SUMERU, (మమీ)—The Northern hemisphere.—A fabulous region over the North Pole, where Indra is said to preside over the Súras or Devatas. (Vide Cuméru).

SU'NYA'T.GA, To say Sweet-A term meaning scarcity; or a time unfavourable for agricultural undertakings, which occurrence is, from time to time, predicted in the Kalendar. Vide p. 312.

SUPTAMI, (& & W The 7th day of the Lunar Pacsha. Vide p. 70.

SURA, (wob)-A measure of time equal to the 1-60th part of a para, which see. Vide also p. 6.

SURABIII, (などか)...The mythological Cow that grants every boon in allusion to the Spring.

SURA DEVI, (おうちょう)—The goddess of wine: sometimes used figuratively to signify the year.

SURA'S, (NOOS)—Benign spirits governed by Indra, harbouring about the North Pole, who with the Asuras churned the ocean, and extracted the Amrita or water of immortality, pending which a furious war broke out among them, in which Vishnu took a part, as well as Surya and Chandra, who were the occasion that Rahu's head was severed from its trunk by the irresistible operation of Vishnu's chacra; all which allegories figure an Eclipse of the Sun, which occurred near the Moon's ascending Node. (Vide Devatas and Asúras).

SU'RYA, (సూర్ప్)—The name most generally given to the Sun (vide Ravi).—Surya savarni, one of the 14 Patriarchs who preside successively over the 14 Manwantaras of the Calpa. Vide p. 311.

SU'RYA SIDDHA'NTA, (ನರ್ನ) ನಿಷ್ಣಾಂತ್ರ)—The first (though not the oldest) of the authentic and inspired Sastras, held in great veneration by all manner of Hindu Astronomers, although they acknowled ge that its elements, without the assistance and use of the tikas, or commentaries, no longer furnish means for representing the true positions of the Planets. It is pretended that this book was revealed 1000 years before the beginning of the Treta yug (A. 3027101. Ante Christum).— European commentators, however, have all agreed to reduce considerably this enormous antiquity, though they still differ vastly in their opinions touching its true epoch; some supposing it to have been written 2050 years before Christ (i. e. 98 years after the Flood), others in the 1268th year of the Christian Æra. Mr. Bentley, however, seems to have proved, after a very profound research, that let the antiquity of the Suryá siddhánta be what it may, it only came into general use in A. D. 538.—Vide the whole of the second Memoir of the Kala Sankalita, and particularly p. 7, 17, 63, 69, 90, 199, 200, 239, 246, 325, 329, and Tables XVII, XLVIII and XLIX.

SU'TRA, (సూర్ర)—A rule, a precept, a computation.

SWA'RO'CHISHA, ( ) 5 5 2 3)—One of the 14 Patriarchs who preside over the 14 Manwantaras of the Calpa, noticed in the Kalendar. Vide p. 311.

SW ATI, (おうる)-The 15th Lunar mansion. Vide p. 74.

SWA'YAMBHUVA, ( న్యామం స్ట్రామం)—One of the Patriarchs as stated, priicle Swarbehicka. Vide p. 311.

Т

TAMIL, (& 2015)-The name of a language, and of an extent of country where that idiom is in general use

TADYA. (ざるざい) - The 3d Lunar day of the Pacsha. Vide p. 70.

TAMASA, (するが)—One of the 14 Patriarchs (vide article Swáróchisha).

(spelt Tomut in the Text), and for which the Solar Kalendar (Fact Pan hanga) is computed. Several European writers, and particularly Missionaries, speak frequently in their books of the lend of Tamil, as if it were delineated upon the Map of India, like the territory of a particular state; but I am perfectly satisfied that none of them entertained any distinct idea of the country they were speaking of. The obscurity into which this designation is involved, has induced me to make some researches of the probable position and extent of the land under consideration; and what follows is an abstract of my information. (1) -4 The Tamil land is the same with  $Dravira_2$ " and comprehends all the districts in which that language is spoken, enclosing a portion of the " Eastern parts of the Peninsula." - When Dravira was confined to the Chola Pandya, and " Chera principalities, its Northern boundary was the Pal-aur river. When the Chola Princes " colonized Tondamandala, it was extended Westward to Tripeti, in a line with Pulicat, at "which some pretend that the land of Dravira was met by that of Tellingana. Other autho-" rities however, extend it to the North, up to the river Chrishna; and the latter supposition " agrees best with our modern notions of the Geography of the country." But if we attempt to estimate the extent of the land of Tamil by that through which the language of that name is spoken, we fall into the region of conjectures, some of which, however, may be grounded on what follows: 66 The Indian dialects which originated in Sanscrit, are said to be ten; viz. " 1º The sacred language used by the Priests and Bhudists in the Island of Ceylon, 2º The " Tamulic, spoken in the Deckan and some parts of the Malabar Coast. 39 The Malabar, " extending from Cape Comari (Comorin) to Mount Illi (Dilly), which separates Malabar from " Canara. 49 The Canarian, used in the districts of Illi and thence to Goa. 59 The Marattah, " spoken by the various nations of that republic. 60 The Telugu, (Tellinga) used on the " Coast of Orixa, and in Golconda (the Nizam's territory', down to the river Chrishna. 79 The " Bengalese, spoken in the province of Bengal. So The Hindustance, which is principally used " in the upper provinces of the Bengal Presidency, but known throughout India, where it has 46 become an intermediate means of communication between people speaking different languages. " 9º The Guzuratic, introduced into Guzurat, Baroach, Borat, Tatta, &c. 10º The Nepalic, of which eight dialects are spoken in Nepal."-What is stated in the second article of this enumeration, agrees well enough with the former Geographical description. We may therefore

<sup>(\*)</sup> These particulars were obligingly communicated to me by Dr. Wilson of Calcutta, and Captain D. Montgomerie, Deputy Surveyor General in India.

take the land of Tamil (when that term happens to be used in a general way) to mean that extent of country which begins on the Southern banks of the river Chrishna, and dividing from thence the Peninsula into two nearly equal parts, descends on the East, down to Cape Comorin.

TAMUS, (తమస్)-The Earth's shadow in an Eclipse.

TATRANA, (ごうどい)\_The 18th year of Jupiter's cycle. Vide Chr. Table I.

TATPARA, (こうな)—(wrongly written Tarpary in the Text)—A space of time; the same at Para. Vide p. 71, 131, 132, 339.

TAYTALA, (Jose)—(written Dhitala in the Text)—The 4th regular Carana. Vide p. 75.

TE'DI, ( c) (Telugu and Tamil)—A date, according to Solar account—(wrongly written in the Text theidi).

Vide p. 73, 77, 164, 313.

TELUGU, (Tenne)—(written in the Text Tellinga)—The land of Tellingana, which is now partly subject to the British power, and partly to that of the Nizam, is bounded to the North by the river Godavery; to the East, by the Sea; to the South by the river Chrishna; and to the West by the river Manujera, which runs into the Godavery at Sungum. The Teluga language is prevalent throughout that extent of land; therefore when Telugu or Tellinga Astronomers are mentioned in the Text, those of the said countries are to be understood; and the same of the Telugu year and Kalendar, when so specifically named, although that year be in fact the common Chandra mana, which is more or less prevalent in all parts of India. Vide Pr. p. vii, viii; Text p. 61, 164, 204, 304, and article Tamil.

TICA', (35)—A commentary.—Most of the siddhantas which have been written by modern Hindu authors, such as the Arya, Parás'ara, and other treatises known by that designation, as well as the ticas of Bháscara A'chárya, Varáha Mihira, and others, may be considered as commentaries on the four principal siddhantas.

TITHI, (3%)—(wrongly spelt Tidhi in the Text)—The 1.30th part of the time which the Moon takes to mave through a Synodical revolution, whatever be its true duration.—It is also considered as the time during which the Moon's motion to or from the Sun amounts to 12°.—A mean tithi (of which there are 371 very nearly in the Solar year) is equal to 50g 3v 3Sp of Hindu time (23h 37' 27", 2 European time); so that 64 mean tithis are very nearly equal to 63 Solar days, and this difference of one day, in the said period of time, is the occasion of the Cshaya, or expunged tithis, which in the Kalendars are called Amavaha or Spric (wrongly spelt Sprohoo in the Text) and which recur once in about 64 days.—When no tithi begins or ends in a Solar day, the preceding tithi is repeated in the Kalendar, and the same numeral answers to two Solar days: it is then called Athi or Athica.—When two tithis end in the same Solar day, the intermediate tithi is expunged and called Cshaya.—The 30 tithis of the Lunar month are divided in two parts, called Pacshas, of 15 tithis each. (See article Pacsha).—The first tithi, independently of its proper name Pád'yami, is also called Prathamu; and the last (Pavanami) Amavasya, meaning that it

is the tithi on which the conjunction falls.—The 15th tithi (also called *Pavarnami*) is distinguished by the name of *Párnimá*, meaning that it is the day of opposition. Vide p. 60, 70, 72, 76, 90, 109, 112, 117, 164, 172, 307, and of Chr. Tables p. xvii and Table II.

- TITHI TATWA, (35) A particular Kalendar which marks all the fasts, religious observances, and ceremonies prescribed on certain days of the year.
- TRAYO'DAS'I, ( あっぱる)—The 13th Lunar day of the Pacsha. Vide p. 70.
- TRETA YUG, ( ). The 3d period of a Maka yug used in the construction of the Calpa; the Hindu silver age, consisting of 1296000 Solar Sydereal years. Vide p. 7, 77.
- TRIDI SPRIC, (うころだいま)—(wrongly written in the Text Tridina sprohoo)—Vide articles Spric and Athica.
- TRÏJYA, ( ) 25 )-A term answering to Radius, being the Sine of 3 Signs or 90°. Vide p. 101, also Duajya, p. 23.
- TRIN, on TRAIRA'S'ICA, ( ) 50-3)—A rule of proportion.—The common rule of three; constantly used in the resolution of Problems of Hindu astronomy.—N. B. This rule is to be found in almost every article of the two first Memoirs.
- TRICO'NA, (もうぞの)—A Triangle.
- TRIVALORE, (さんかつめ)—A village in the Tanjore province, to which certain Astronomical Tables refer. According to the Hindu Geography, it lies 3° 32′ 58″ E. of Lanca in Longitude, and in 10° 44′ N. Latitude. Vide Tables XXXIII and XXXIV.
- TULA, (పరణాం)-The 7th Sign of the Hindu Sydereal Zodiac, Libra 2. Vide p. 5 and Table III.
- TUNGA, UCHA, (色文)—Superior, higher Tunga manda, or Mandaocha; the superior Apsis or Aphelion of a Planet. Vide p. 83, 84.
- TYA'JYA', (TSS)—(wrongly spelt in the Text Thyajum and Thyagum)—That portion of a Nacshatra, which is deemed unlucky, is called Varjya, and the period of its duration is the Tyájyá.—It is called Devi when it occurs at day time; and Ravi when at night. It is therefore an astrological element: but is nevertheless registered every day in the Ephemerides; where the instant of its commencement is registered. Its mean duration is about 4 guddias (1h 36' European time), so that the beginning being known, the end may be supported, with sufficient accuracy for practical purposes, without actual computation. Vide p. 75, 181, 307, also article Varjya.
- TYE, (1)—The 10th Tamil Solar month, answering to the Hindu Mághá, when the Sun is in the Sign Macara vs. Vide p. 5 and Table III.

## V

\* VACIJ, (50 3 2 )-Spelt in the Text Vachij, after Father Beschi's orthography.—This term, like that of Sittandij, is unknown to the Madras Pundits, but it is unquestionably used in the provinces of

- Madura and Tinnivelly to designate a particular sect of Astronomers who reside in the Northern parts of the land of Tamil; vide p. 7 and Table I.
- VAIDHRITI, (వైద్య 3)—The Yoga Star of the 27th Nacshatra or Lunar mansion, Z Piscium; vide p. 19, 74, 215.
- VAISA'CHA, ( ) The first month of the Hindu Solar year, when the Sun is in the Sign Mésha γ, answering to the Tamil Chitram. Vide p. 5 and Table III.
- VAJRA, ( a z ) \_ The Foga Star of the 15th Lunar mansion, Arcturus. Vide p. 74.
- VAKYAM, ( ) (1s written in the Text, but according to adopted system Vacyam). The Solar process for all manner of astronomical computations; vide the whole of the second part of the 2d Memoir, from p. 118 to 148.—Vacyam dharmavana, an element of this process, being the remainder after division of the Ahárgana by a vedam, rasa-gérica, cátánila and dévaram, which remainder, expressing a number of days expired of the current dévaram, is the argument for using the first vaciam table (the XXVIII) of this collection). Vide p. 19, 118, 122, 132, 133, 230, 336, and Tables XXVI, XXVII, XXVIII and XLVII.
- VA'MANA', (మామన)—One of the incarnations of Vishnù in the form of a Brahmin Decarf; the anniver-sary of which is noticed in the Kalendar. Vide p. 311.
- VANATA'NS'A, (あるぎっち)—(as spelt in the Text, but according to our orthography Avanutansa)—
  Altitude.—Avanutansa bhágas, degrees of altitude of an object above the horizon.
- VA'RA, on VA'SARA, (\$\omega \cdot \delta \de
- WARA'HA, (Social)—One of the incarnations of Vishnù, in the form of a Wild Hog, the anniversary of which is noticed in the Kalendar; vide p. 311.—An Astronomer, the reputed author of a system of Astronomy referred to in the Súrya, Vasist'ha, and Sóma Siddhantas, and therefore supposed by modern Sastris to be anterior to them all. But European commentators entertain a belief that the work which goes by Varaha's name in present times, is not the real one; and that the treatise which has reached us, is a fabrication of no older date than the IXth century.—Varáha Mihira, another Astronomer, thought by many to have been cotemporary with the Emperor Achar; but whom others are apt to confound with Varáha Acharya, and others of the same name.—N. B. The Telugu Astronomers pretend that Varáha Mihira flourished in the 3600th year of the Cali yug (A. D. 499), i. c. at the close of the 2d Padah of the Ayanansa, when the Sun, Moon, and Equinoctial points (according to the doctrines of the Surya Siddhanta) were in

the first point of the Hindu Sydereal Zodiac; or, in other words, when the Rishis were in the 1st point of the Solar Sign Mesha  $\gamma$ , and in the same of the Lunar mansion Ascini.

VARGA, (\( \sum \chi \) - See Varga.

VARI'YA, (ごう エア)—The Yoga Star of the 18th Lunar mansion, Antares; vide p. 74.

- VARJYA, (SEGE)—(wrongly spelt in the Text Wurjum)—A certain point in each Nacshatra, or Lunar mansion, called its Dhruva, determines the duration of this astrological element; and the time which the Moon's disc takes to move across this ill-omened point, is called the tyajyá; the mean duration of which is about 4 ghadyas of time (1h 36' E. T.); but its true duration is greater or less according to the Moon's continuance in the incumbent Nacshatra, which depends on her position relatively to her Apogce, and determines whether her stay in the mansion be more or less than 60 ghadyas.—The tyájyá of the varjya is always punctually registered in the Ephemerides of the Kulendar, of which it is one of the five permanent articles, by stating the time of its beginning. Pending its duration, all voluntary business of importance must remain suspended; but as the instant of its ending is not announced in the Kalendar, people calculate generally on 4 ghadiyas of inaction from the beginning of the varjya.
- VARSHA, (\$\sigma \sigma \)—The third season of the Hindu Solar year, comprehending the months of Sravana and Bhadrapada, when the Sun is in the Signs Carcata & and Sinha &, answering to the Tamil months Audi and Auvani; vide p. 4.
- VASANTA, (Σ κόδ)—The first season of the year, comprehending the Solar months Chaitra and Vaisac'ha, when the Sun is in the Signs Mina × and Mesha γ, answering to the Tamil months Pungoni and Chitram; vide p. 4.
- VAVILALA CUCHINNA, (De Dere, Service)—A Telugu Astronomer who is supposed to have flourished in the 4399th year of the Califyug. He has left some tables for computing the position of the Planets, and some tracts on the construction of the Luni-solar Kalendar, of which the Appendix to the second Memoir of this collection is one. These are much esteemed by the Astronomers in Telinguna. Vavilala's computations refer to the meridian of Lanca, and agree better with the doctrines of the Surya Siddhanta than those of any of his compatitiots; vide p. 81, 153, 167, the Appendix to the 2d Memoir, and the Tables from XLI to XLV.

VAYU, (ゴーゴン)—The Atmosphere.

- VE'DAM, ( \$\frac{1}{2}\$\times 0)-An element of the vacyam, or Solar process; containing 1600984 days; vide part 2, second Memoir, and p. 122, 132, 133, 335.
- VE DAS, ( 2)—The inspired books, four in number, viz. 19 The Rig; 29 The Sama; 39 The Yajur;

  40 The Atharvana vedas. (For the particulars of each, see the respective terms).
- VE'DHEI, ron VETHEI. (るち)—An astrological element, an account of which is given at pages 76, 308 and 309 of the Text, and noticed in all the Ephemerides.

VELLI', ( 2) The Tamil name of Venus.

VI.ARCENDU SANGAMA, (ప్రాక్ట్ – ండు)—(wrongly spelt in the Text Vi.arca-Indu-Sangama)—Conjunction of the Sun and Moon. Vide p. 70, 89, 90; also Arcéndu Sangama).

VIASSEI, (ﷺ)—The 2d Solar Tamil month, auswering to the Hindu Jaisht'a, when the Sun is in the Sign Vrisha &; vide p. 5 and Table III.

VIBHAVA, (のまな)—The 2d year of Jupiter's cycle; vide Chr. Table I.

VICALA, (5) \$ (5) The 1-60th part of a cálá. The second of a degree.

VICARI, (3 30) \_ The 33d year of the cycle of Jupiter; vide Chr. Table I.

VICRAMA, (వ్రిమ)—The 14th year of the same.

VICRAMA'DITYA, (D & South S)—A Prince who has given his name to an Era, and who is said to have flourished 135 years before Sáliváhana. Its epoch falls when 3044 years of the Califyug had expired. The Era Vicramaditya is little used in the Peninsula of India, although its current year be generally inserted at the head of the Kalendars.—In those provinces where it is current, it serves to number the Luni.solar years, in the same manner as the Era Salivahana in the Carnatic for the Solar ones; vide p. 18, 293, 295, 302, 303, 313, 318, and of the Chr. Tables p. xii, and Table II.

VICRITA, (38.3)—The 24th year of Jupiter's cycle; vide Chr. Table I.

VI'CSHEPA, (3 & 2)—Celestial Latitude (vide Patana).—Vicshepa Dhrura, the greatest inclination of a Planet's orbit; vide Parama'pama and p. 74, 91, 342.—Vicshepa pataca cala. See Tableat p. 342.

VIDIYA, or DWITYA, (でんなア, なんもない)—The second Lunar day of the Pacsha; vide p. 70, 112.

VIGHAD'IYA, (Swadow)—(spelt in the Text viguidia)—The 1-60th part of a ghadiya; an Indian minute, equal to 24 seconds European time.

VIJAYA, on VIJYA, (ひまな) \_The 27th year of Jupiter's cycle; vide Chr. Table I.

VILAMVA, on VILEMBI, (のぞのむ)—The 32d of the same.

VILIРГА, (De z)-- See Vicála and Múrta).

VIMARDHA RDHA, (のも) 中でなっています。 The time from the apparent conjunction to the end of an Eclipse. (Vide Sthityardha).

VINADICAY, (るるではず)--The 1-60th part of a nashicay; vide p. 5, 71.

VIPALA, (3 2e)-The same as a pranaca'la', the 1-6th part of a pala; vide p. 5.

VIRDHAMANDA P'HALA, (వ్యవం దళల)—The equation of the second inequality in the motion of the inferior Planets. (Vide Sighra and Sighra Chaturtha).

VIRO'DHACRIT, (వరోధకృట్)-The 45th year of Jupiter's cycle; vide Chr. Table I.

VIRO'DHI, (あるでな)-The 23d of the same; vide do.

VISA'CHA, (るずぬ)\_The 16th Lunar mansion; vide p. 71.

VISHAMA, (255) -A Planet is said to be in vishama when it is in 90° from the Apsides. - The Sun is in

vishama, when he is in the Equinoctial points.—Vishama ch'háyá, the Shadow of the Gnomon at midd y when the Sun is in the Equinoxes, (vide Palabha).—Vishama carna, the hypothenuse of a right angled triangle formed by the Sancu (Gnomon) and the two sides of the Shadow; vide Sama and Paridhi, also p. 91, 94.

- VISHCAMBHA, (550 \$)—The Yoga Star of the 1st Lunar mansion; supposed to be γ or β Arietis; vide p. 74.
- VISHU, (Sas)-The Tamil name for the 15th year of Jupiter's cycle, the same as Brisya.
- VISHNU, (Sex)—The second person of the Hindu triad,—the preserving power, too well known to be further particularized.—Vishnù is often taken as a personideation of time, as well as Siva; vide p. 311.

  —Vishnu dhár moottara, a treatise on astronomy.
- VI/HUVA, (Dand)—The Equinoctial points, called also Ayanas, Dhrunas, and Cranti-Patas.—Vishuna dina, the day of the Equinoces.—Vishuna ch'héya, the Shadow of the Gnomon at noon on those days; vide Vishama, and p. 84, 313.
- VISHWAYVASU', (うでうばん)—The 39th year of Jupiter's cycle; vide Chr. Table I.
- VISTI, (\$\infty\$)-(spelt Vuiti in the Text.)-A name for the 7th and ordinary Carana, also called Bhudra; vide p. 75.
- VRIDDHI, ( ) The Yoga Star of the 11th Lunar mansion; very uncertain; perhaps 70 or 71 Leonis:
- VRIDDHYARGHA;(る ちんだ)—A term used in the Kalendar to signify Abundance; Plenty.—It also means the time favourable for agricultural operations (astrological); vide p. 312.
- VRIHASPATI, or VARAHASPATI, (2) 50 3)—One of the most common names of the Planet Jupiter.

   Vrihaspati chacra, the cycle of 60 years which gives a specific name to all the Solar and Lunicolar years.—Vrihaspati mana, the year of Jupiter, during which he describes one sign of his orbit.—N. B. The Telugu Astronomers make no difference between this and the common Solar year; vide p. 70, 147, 195, 212, 296, 303, and the Tables from XI to XIX; also Chr. Table I.

「TRISHA, 考点版)\_The Solar Sign Taurus &; vide p. 5 and Table III.

VRISCHICA, (జ్స్ట్రేక్స్ The Hindu Solar Sign Scorpio m ; vide do.

VRITHAM, (550)-Fast, or day of fasting; tide p. 311.

VURGA, ( $\lesssim NF$ )—(so spelt in the Text, but perhaps more correctly Varga.)—The equare of a number.—

Varga mila or meta, the square root of the same; vide p. 343.

VYAYA, (Zoth) -The 20th year of Jupiter's cycle; vide Chr. Table I.

VYA'GHATA, ( ) The Yoga Star of the 13th Lunar mansion: uncertain; perhaps 7 or 8 Corvi.

VYANGULA', まらんだめ)—The 1.60th part of an angula', or digit (wrongly spelt in the Text vincula)—A measure used in the computation of Eclipses, and Gnomonic Problems.

. VYA'SAM, VISHCAMBHAM, VISTRITI, (నా క్రసం)—Terms used to express the diameter of a circle.

VYATI'PA'TA, (క్స్ పే ార్త)—The Yoga Star of the 17th Lunar mansion, g Scorpii. Vide p. 74.

VYWASWATA, (ごるないる)—One of the 14 Patriarchs who preside successively over the 14 Manwanturas of the Calpo. Vide p. 311.

U

UCHA, ( The Apses of a Planet's orbit. (Vide Mandocha.)

UJANI, ( ( wrongly spelt in the Text Ujjayini)—A city under the same meridian as Lanca; supposed to lie near the modern town of Oogein. Its Longitude from Greenwich, is therefore 75° 35′ 16° E. Its Latitude is 23° 11′ 30″ North. Vide p. 9.

ULLAGNA, Égy X )—The Lagna of a particular place; answering to the oblique ascension of the asters, in any place which has Latitude; vide p. 92, 101, 103, 104, where the Ullagna of Madras is given for every Sign of the Zodiac; and Table XLVI, for the Latitude of 16° 15'.

UPIIA'DI, (台分)—(wrongly spelt in the Text Opadi)—A term referring to the Luni-solar Kalendar, and meaning an expunged day. Vide Tithi; also p. 72, 311.

UTPA'TA, (& 3)—Some natural prodigy or phonomenon.

UTTAMA, (意気シ)—One of the 14 Patriarchs who preside successively over the 14 Manwantaras of the Calpa. Vide p. 311.

UTTARA, ( Wrongly spelt Vutra in the Text)—The North point.—When Uttara is prefixed to the name of a Nacshatra, it means the second of the same name. (Vide Purva.)

UTTARA JYA, (ఉ క్రజ్న్)-The versed Sine of an Arc. Vide Table XXX.

157

WARNIJA, (ప్రక్టిల)—(spelt in the Text Warnaji)—The 6th and ordinary Carana. Vide p. 75.

WURJUM, (≾≈SFO)—See Varjya.

WUTRAJYA, ( S & S)—An element of Hindu Spherical Trigonometry. Vide p. 99, and for the demonstration p. 42 of the Tables.

Y

YAJUR VE'DA, (మజు ేస్ట్ జ)—The second of the inspired védas, which comprehends the whole science of religious rites and ceremonies, such as fasts, festivals, purifications and sacrifices.

YAMA, (నుమ)—The godhead who presides over the Asúras or Baityas. (Vide Devatas).

YAVA COTI, (యవకోటి)—One of the four imaginary cities supposed to lie under the Equator at a distance of 90° from each other, Yava-coti being West of Lanca. Vide p. 9.

YECADASI, (2 5 62) The 11th Lunar day of the Pacsha. Vide p. 70.

\*YO'JANA, ( こうこう)-An Astronomical and Geographical measure, deduced from the ratio of the diameter of the Earth to the circumference of its Equatorial circle. The dimensions of the yojuna, like those of any other measure, originate in an arbitrary division of extent, for which the Hindus have chosen a finger or angulá, as a standard to be found in nature. By that common measure they estimate not only distances, and the dimensions of the Earth, but even the distance of the Planets, their Parallaxes, and (when referred to particular points on the surface of the Earth) the effects of their Longitude and Latitude as to time. The Hindu Mathematicians divide the diameter of the Earth into 1600 parts, whence they have this expression 1/10×1600=5059,6 vojanas for the value of the Equatorial circle. An angle of one minute of a degree is supposed to be subtended by 15 yojanas, at the mean distance of the Moon; so that dividing the Earth's semi-diameter (SOO yéjanas) by 15, we have 53' 20" for the Moon's mean horizontal parallax. It follows from this result that 52' 20' of the Moon's orbit will measure 15 yójanas, and that her whole orbit (360°) will measure 324000 yójanas. Hence 5059 (the circumference of a great circle of the Terrestrial Globe in vojanas) is to 800 vojanas (its semi-diameter), as 324060 (the circumference of the Moon's orbit in yójanas) is to 51235 y ójanas her mean distance from the Earth: from which it follows that this distance (according to the estimates of Kindu Astronomers) is about 64 semi-diameters of the Earth .- As the Moon is supposed to complete 57753336000 Sydereal revolutions in a Calpa, this number drawn into 324000, gives 18712080864000000 yójanas for her absolute motion during that time. - It is a principle in Hindu Astronomy "That the absolute motion of each Planst in a day, or any other "given time, is equal to the absolute motion of the Moon in the same time."-Hence if the absolute motion of the Moon during a Calpa, be divided by the number of mean revolutions completed by any Planet, during that period, it will give the Cacsha, or circumference of the Planet's orbit in yojanas. To convert degrees of Latitude and Longitude into yojanas, they use the following proportion: "As 360"; to the proposed number of degrees; so 5059 yójanas (the 64 circumference of the Equatorial circle), to the number of yojanas sought."-The Hindus subdivide the yôjana into a great number of parts, in the following manner: The yôjana  $\div 4$ crosas ÷ 1000 dhanush, or dandas ÷ 4 restas, or cubits ÷ 2 vitistis, or spans ÷ 2 padas, or foot breadths ÷ 6 angulas, or finger breadths ÷ 4 yaras.—Some make the crosa = 2000 dandas, or half a ybjana, which agrees better with that in which the distances are usually computed. Vide Art. 8, Sect. I of the 1st Part of the 2d Memoir, p. 92, and the 2d Fragment, p. 330.

YECJYA, (\\ STS\—(Vide Duajya, Trijya).

YO'GA, (\$\overline{\text{COTO}}\$)—The leading or principal Star of a Lunar mansion, the position of which is given in the Hindu Astronomical Tables.—On these we shall only observe that in taking the Latitude and Longitude of Stars, as laid down in these catalogues, the former is to be considered as an arc of

the meridian which intersects the Star and the Ecliptic; and the latter as the portion of the Ecliptic which is intersected by the same meridian, and the Equinoctial Colurc. There are 28 Yoga Stars (including Abhijit) in the Lunar Zodiac: but with the exception of 16 or 17 of these (on the identity of which there can be little doubt), it is very uncertain to which of the Stars in the European catalogues, the remainder corresponds.—Harshana (which no doubt is the same as our Spica Virginis) seems to be the Yoga which drew most the attention of the ancient Hindu Astronomers; probably on account of its convenient magnitude, and declination; which at the beginning of the IXth century was 9° 38' 13' S .- To this Star they referred the beginning of the 7th month of their Solar Sydereal year, from which they concluded its beginning; and there is every reason to suppose that it was on the result of observations of Harshana that they established their Cranti. Pata. Gati, or precessional variation; a surmise which, if correct, offers a singular concurrence of circumstances, for it was by observations of the same Star that Hipparchus first discovered (in the IId century before Christ) the motion of the fixed Stars from West to East; vide p. 19, art. 9 .- Yogu, a term so pronounced by the Telugu Astronomers, and thus written in the Text, but Yoga as spelt by the Carnatic Sastris, is an astrological element, containing the same number of accidents as there are Yogas in the 27 regular mansions of the Lunar Zodiac; bearing the same names, and arranged in the same order; but having no sort of Astronomical reference to them .--A Yogù is the time during which the sum of the motions of the Sun and Moon, amounts to one Nacshatra, or 13° 20'. Its mean duration is 59g 29v 21p,75 Indian time (23h 47' 41" 24" European time); 17 of which are nearly equal to 16 days; which occasions an equation somewhat similar to that of the Cshaya tithi (which see). Vide p. 7, 19, 74, 77.

- YOCHIADI PATACA, (యా ార్థ్ చక్క)—The second Table of the I qeya process (the XXVIIth of this collection), giving the equation of the Sun's motion, considered at the rate of I degree for a day, to his true motion for every 8th day in the year. Vide p. 124 and following.
- YUDNISHT'HIRA, (ముధ్రప్రేష)—A Prince of great celebrity in Hindu history, who according to Indian authors, reigned about the beginning of the Cali yug; some, however, fix the epoch of his reign 653 years later, or in the year 2448 before Christ. He is said to have been cotemporary with the Astronomers Parására, and Garga.
- YUG, on YUGA, (SOX)—Signifies properly the conjunction, and sometimes the opposition of the Planets. It is, however, more generally used for signifying a long period of years, at the expiration of which certain phænomena, or circumstances, recur.—The principal Yugs made use of in present times in Astronomical computations, have been mentioned and explained under the respective heads of Maha yug, Satya, Treta, Dwapara, and Cali yugs, and need not be repeated in this article.—It is, we believe, generally admitted that ancient Astronomers invented their Yugs with reference to some of Jupiter and the Sun's conjunctions, in the Leginning of the Zodic; and

that more recent ones, (with a view to lengthen their periods), have referred them to those of Saturn and the Sun.—But modern European commentators have made such prodigious alterations in the epochs and durations of these Yugs, without changing their names, that we shall not attempt to follow them in a Glossary, which was only intended for facilitating the reading of the present work, and the study of modern Hindu Astronomy, with reference to that system of Chronology, which was followed in India since at least, thirteen centuries, an estimate which is by no means overrated, even if we adopt the opinions most unfavourable to the antiquity of the Surya Siddhanta; vide p. 7, 77.—Yuga dina (sometimes written yugadia) means the anniversary of the day on which the current Maha yug, and any one of the four lesser Yugs began; which anniversary is always noticed in the Kalendar.—Telugu Astronomers use sometimes the term Yugadia, for Ahargana. Vide p. 240, and Chr. Table II.

YURKA, or GURUJAH, (ముక్లా, గరజ)—The 5th and ordinary Carana. Vide p. 75. YUVA', (ముక)—The 9th year of Jupiter's cycle. Vide Chr. Table I.

END OF THE GLOSSARY.

## INDEX

Of Arabic, Persian, Hebraic, and Hindustanee words, and terms, used in the Kala Sankalita.—N. B. The orthography is that of the French Chronologers of the last century.

The languages are distinguished by A for Arabic, P for Persian, H for Hebraic, and Ind. for Hindustanee.

Aaron-al-rashid, 219. Ab, H. 301. Aben, P. 297.

Abib, H. 301.

Adar, P. 297, H. 301.

Adu, H. 300.

Affirer, or Assirer, P. 297.

Ahad (Yoom-el) A. 221.

Albategni, 219.

Alfragan, 219.

Alhazen, 219. Almamon, 219.

Ahnoud, P. 297.

Aniran, P. 297. Arbaa (Yoom-el) A. 221.

Ardihast, or Ardisasht, P. 297.

Ardabshest, P. 297.

Arzashel, 219.

Ashnoud, P. 297.

Asrudia, or Aphrudia, P. 297.

Avul Hafta, Ind. 221.

Azur, P. 297.

В

Badu, H. 300. Behen, P. 297.

Beheran, P. 297. Behman, P. 297.

Bod, P. 297.

Bul, H. 301.

Cardi, P. 297.

Char Shumbol, Ind. 221.

Cisleu, or Casleu, H. 301.

D

Dgelal-ul-deen ; Dgelalean, 297.

Digooma, (Yoom-el) A. 221.

Dahioush, P. 297.

Di, P. 297.

Dibameher, P. 297.

Dibadin, P. 297. Dibadur, P. 297.

Din, P. 297.

Effabt (Yoom-el) A. 221.

Elul, or Ehanim, H. 301.

Epagomenes, 297.

Erd, P. 297.

Esphendarmer, P. 297.

Ephendarmod, P. 297.

Etwar, Ind. 221.

F

Fevardin, P. 297.

Fuzelee, of Indian Chr. Tables page ix, and

Table II.

Giumadi, or Giumasil (cl-Avul, and el-Au-

keer) A. 221, 224, 226.

Hejira, x, 219, 230, 233, 296, and refers to page ix and xiv and Chr. Table III.

Heshounesh, P. 297.

Hormozd, P. 297.

I

Islar, H. 301.

J

Jiar, H. 301.

Jumma and Jemma Rhaut, Ind. 221.

M

Kamis, (Yoom-el) A. 221.

Kebie, H. 300, 301.

Khordad, P. 297.

Khour, P. 297.

Mab, P. 297

Mahorum, A. 221, 224, 226, 232. Marasfend, P. 297. Marshesvam, H. 301. Meh, P. 297. Meca, and Medina, 220. Merd-d, or Mordad, P. 297. Mungul, Ind. 221.

N Nahonassaar, 220, 294, 302. Nisan, H. 301.

Olympiads, 294, 302. Omar, 219. Osman, P. 297.

01

Peer, Ind. 221.

R
Rabi (el-Avul and el-Aukeer), A. 221, 221, 223,
Ram, P. 297.
Ramadan, or Ramazan, A. 221, 225, 226, 316.
Ramiad, P. 297.
Regeb, or Regihab, A. 221, 225, 226.
Resh, or Roush, P. 297.

S

P

Saabath, H. 301.

Saros, or Sossos, 59, 302. Sen, Shahaban, A. 221, 225, 226. Sharivar, P. 297. Shawal, A. 221, 225, 226. Shebeth, H. 301. Shirbirir, P. 297. Sieban, H. 301. Souroush, P. 297. Suffer, or Sepher, 221, 224, 226.

Tarik Dilcarnaim, H. 296.
Thaleth (Yoom.el), A. 221.
Thamuz, H. 301.
Thani (Yoom.el), A. 221.
Thebeth, H. 301.
Thebith-Ben-chora, 86, 219.
Thir, P. 297.
Thisri, H. 301.
Tir, P. 297.

Vahest, P. 297. Ve-Adar, H. 299, 301.

Y Yezdegird, Yezdegirdic, 207.

Z Zoolcada, or Zoolcayadah, A. 221, 225, 223. Zooledge, or Zoolcagiadah, A. 221, 225, 226.

HANN KANA KANA

## On the Hindu Holy days and Festivals.

I SHALL offer but a few words on this subject, which has long since been laid before the public by Sir William Jones in his translation of Raghunandana's tract, containing an account of the rites and ceremonies observed generally by the Hindus during the course of the Luni-solar year. (\*) My sole motive for enumerating these epochs anew, was to comply with the wishest of several Pundits with whom I had intercourse during the present research, and who conceived that my account of their various Kalendars would be incomplete if the present article were omitted.

I have compared the present list with that given in the *Tithi Tatwa*; and with the only exception that the latter is much fuller, and consequently more satisfactory than the present one, I have found no material difference between them. The variations which occur are to be ascribed to local customs and circumstances; and therefore the present catalogue must be especially referred to the inhabitants of the Carnatic, although the same observances may be kept in other parts of India.

Of the fixed and moveable feasts.

These words are to be understood in their literal sense when referred to the respective Kalendars on which the festivals depend; but not so when these are compared, or referred to the European Kalendar.

Thus for instance the festival of Sríráma-navamí, always falls on the ninth Tithi of the first Pacsha, of the Lunar month Chaitra, and therefore, in as much as the Chandra Panchangum is considered, it is a fixed holy day. But it is clear that it must occur sooner or later every year, when referred to the Ravi Panchangum, according as the beginning of the Lunar falls nearer or farther from that of the Solar year.

The Hindus of the Carnatic observe 37 principal feasts during the course of the Luni-solar year; 32 of which are fixed, and 5 are moveable, in the sense above explained.

Besides these, there are five holy days governed by the Solar Kalendar: four of which are determined by the Epochs when the Sun is in the Equinoctial and Solstitial points of the Sydereal Ecliptic. The fifth is only one of recreation. The natives of these Provinces observe, therefore, forty-two holy days in all.

Of the holy days which are governed by the Luni-solar Kalendar.

- 1. Yugadi Pundaga.—The 1st Tithi (Lunar day) of the Chandra Sumvatsara, called Siddhanta Chandra mana in the Carnatic, and reckoned in Bengal according to the style of Vicramaditya.
- 2. Sriráma-navami.—The 9th Tithi of the 1st Pacsha of the Lunar month Chaitra; which is the anniversary of the incarnation of Vishnù in the shape of a Rajah, or Prince of the cast of Ushetria.—A day of prayer and recreation, though some devout Brahmins keep fast.

- 3. Madana-trayódasí.—A festival in honor of Cáma déva the god of love. This is observed on the 13th Tithi of the 1st Pascha of the Lunar month Chaitra; but principally in the Northern Provinces.
- 4. Chittera Pavarnami.—The 15th Tithi or day of full Moon in Chaitra, on which day C. tters Gupta (the recording spirit of Yama's chancery) is commemorated.
- 5. Balarama Jayenti; Acsháyá Tritiya.—The 3d Tithi of the month Vaisácha, 1st Pacsha.—N. B. When certain days of the Moon fall on certain days of the week, they are called Acsháyás, or imperishable. The present festival is subject to this contingency; but it is not considered so in the Carnatic.—This Tithi is the anniversary of the beginning of the Treta yay; and a day of recreation.
- 6. Neisinha, or Narasimma Jayenti.—The 14th Tithi of the 1st Paesha of the Lunar month Vaisa cha; being the anniversary of Vishnu's incarnation as half a lion, and half a man.
- 7. Vyasa Pavurnami or Dánamá vasyacam.—The 15th Tithi or full Moon of the Lunar month A'shád'ha, kept in commemoration of Vyasa (one of the Avotaras). He was one of the most celebrated Penitents, and the reputed author of the 18 principal, and 18 inferior Puranas, and also of all the Mantras or forms of prayer, in existence.
- 8. Garuda Punchami; or Nága punchami.—The 5th Tithi of the Lunar month Srávana, on which day the serpent of Vishnù is worshipped.
- 9. Vara Lacshmi Veittum.—(Moveable). This holy day is always kept on the Friday which precedes the full Moon of the Lunar month Sravana, reserved for Lacshmi's worship.
- 10. Rugoopah Curmum.—(Moveable); to be observed on the day when the Moon is in the Nacshatra Sravana. The Brahmins begin to read the Rig veda on this day.
- 11. Ejurupa Curmum.—The 15th Tithi, or day of full Moon of the Lunar month Sravana. On this day most of the Brahmins renew their sacrificial chord; and begin to read the Ijur veda.
- 12. Crishna Jaumushtami.—The 8th Tithi of the 2d Pacsha of the Lunar month Scavana.

  The anniversary day of Vishni's incarnation into the person of Sri-Clishna.
- 13. Somapa Curmum.— The 3d Tithi of the 1st Pacsha of the Lunar month Bhadrapada; on which the Brahmins who follow the doctrines of the Soma vedu renew their sacrificial chord; and besin to read that vedu. (\*)
- 14. Vinayaka, or Ganésa Chaturt'hí; also Heritálicà.—The 4th Tithi of the 1st Paesha of the month Bhadrapada. An inauspicious day; because Crishna was falsely accused in his childhood to have stolen a gold gem from Praséna on that day.
- 15. Rishi panchami.—The 5th Tithi of the same month and Pacsha, on which the memory of the seven principal Rishis or penitents is commemorated.
- 16. Ananta Chatardasi.—The 14th Tithi of the same month and Pacsha; sacred to Vishnu, under the cpithet of infinite.
  - 17. Maha lacyaramba, or Aparapacsha, and Bráhma sávítri.—The 1st Tithi of the 2d Pacsha

<sup>(4)</sup> The Athara veda, is either supposed to be lost, or to be concealed as a bad book; and therefore never read (at least aroundly) by the Brahmins.

of the Lunar month Bhadra, on which the Hindus begin to worship the Pitris, or spirits of decrased ancestors.

- 18. Madhya Astami.—The 8th Tithi of the same Pacsha and month; a day on which it is meritorious to observe the Srardum, which when done, produces the same effect as if that ceremony had been performed during every other day of the Pacsha.
- 19. Cali-yugadi.—The 13th Tithi of the same month and Pacsha; being the anniversary of the beginning of the Cali yug.
- 20. Navarátricam, or Aswina Sudham.—The 1st Tithi of the month Aswina, consecrated to the worship of the goddess Dargá. On this day the Dussera feast is celebrated. It is one of the most important and splendid of the year.
- 21. Saraswati Puja rumbha.—(Moveable); to be observed on the day when the Moon is in the Nacshatra Mula in the 1st Pacsha of the month Aswina. On this day all Hindus begin to collect their books, and the instruments of their trade and profession, for the purpose of future adoration.
- 22. Saraswati Puja, or Mahánavami.—The 9th Tithi of the 1st Pacsha of Aswina; a day of devotion; bathing and reading certain Mantras.
- 23. Vij nyá Desami.—The 10th Lithi of the same Pacsha and month; on this day are worshipped all the books, arms, and instruments of trade which were collected on Sarasweti Puja rumbha.
- 24. Naraca chain dasi, or Bhita chain dasi Yamaterpanam.—The 14th Tithi of the 2d Pacsha of the month Aswina, on which Yama (the judge of the dead) is worshipped: the ceremonics performed on this day begin with the morning twilight or Pratha Sandhya.
- 25. Dipavali, or Lacshmi pujá dipánvitá.—The 15th Tithi or day of full Moon of the month Aswina. On this day the Hindus begin to wear new clothes, and on that occasion entertain their friends: this is also the epoch for settling accounts, and hoarding up treasure. At midnight all the votaries of Lacshmi shut up their money in a coffer, and worship it in honor of their tutelar goddess.
- 26. Scanda-shasti.—The 6th Tithi of Cartica, 1st Pacsha. A day of fasting in honor of Subra mania, son of Siva.
- 27. Crita Yugadi or Durgá navami.—The 9th Tithi of the 1st Pacsha of the month Cartica; and the anniversary of the beginning of the Crita yug.
- 28. Uit hánaicádasí. The 11th Tithi of the 1st Pacsha of the same month, the anniversary of that on which Vishnù awoke from his slumber of 4 months: a day for contemplation.
- 29. Survalaya Deepum, or Dúnamúvasyacam.—The 15th Tithi, or time of full Moon of the month Cartica: on this day all the pagodas and private houses are illuminated, and the rich entertain their friends.
- 30. Cártica Deepum.—(Moveable); this festival depends on the day on which the Moon is in the Nacshatra Critica during the month Cártica: it is a day of fasting in commemoration of Subramania.
  - 31. Moocoti Yacadesi .- The 11th Tithi of the 1st Pacsha of the month Margasiras. A general

fast to be observed in honor of Vishnu, and kept all the day and night: no one should indulge in sleep during the whole course of the Tithi.

- 32. Radha, or Bascara Seplami.... The 7th Tithi of the 1st Pacsha in Magha. A fast in honor of the Sun, as a form of Vishnu.
- 33. Bishma Yacadesi, or Bhaimi.—The 11th Tithi of the 1st Pacsha in Mágha. Ceremonies to be performed with Tila or Sesamum, in honor of Bhima.
- 34. Maha Siva Rátri.—The 14th Tithi of the 2d Pacsha in Mágha. A rigorous fast to be kept, with extraordinary ceremonies in honor of Siva-linga, the Phallus of the Indians.
- 35. Dwapara yugadi.—The Amavasya or conjunction day which determines the end of the Lunar month Magha, being the anniversary of the beginning of the Dwépara yug.
- 36. Camadahánum Holica, or P'halguts wa; vulgarly called Huli.—The 15th Tithi or full Moon of the month Phalguna. This festival was ordained on account of the near approach of the Vernal Equinox. All classes of Hindus sport on this day in honor of Govinda, who is carried about in a palankeen. It may be compared to the Saturnalia of the Romans, for all classes of Society are confounded whilst it lasts.
- 37. Pungoni Uttara.—(Moveable); this festival, which is kept in commemoration of the marriage of Siva, Vishnù and other gods, is to be kept on the day when the Moon is in the Nacshatra Phalguni. On the above account this day is held auspicious for marrying.

#### Solar Festivats.

- 1. Varsharumbum.—The beginning of the Solar Sydereal year; kept therefore on the 1st day of the month Vaisác'ha (Tamil Chitram) when the Sun enters the Sign Mesha  $\gamma$ . This holy day is kept by resorting to the sacred rivers, giving alms, and sacrificing to the Pitris, or spirits of deceased ancestors: also a day of recreation.
- 2. Dechanayan'a Punia Calum.—The 1st day of the month Sra'vana (Tamil Audi) when the Sun enters Carcata . The same observances as for Vaisúc'ha.
- 3. Andy Pundaga.—The last day of the same month, a day of recreation and entertainment; on which the Hindus feast on boiled cocoanuts.
- 4. Vishu Punia Calum.—The 1st day of the month Cartiga (Tamil Arpesi) when the Sun enters the Sign Tula : the same observances as for Vaisac'ha.
- 5. Uttarayana Punia Calum.—The 1st day of the Solar month Magh (Tamil Tye) when the Sun enters the Sign Carcuta vp. This is the grand festival of the Pungol, on which day, after the usual bathings, giving of alms, and sacrifices to the Pitris, the Hindus offer boiled rice to the Sun, then scatter it over their fields to propitiate abundance. At the end of the ceremonies, they worship the Cow, and then it is pretended that some ill luck falls on a particular animal which becomes a victim for the general safety.

Matoo Pungol.—This is a continuation of the feast which began on the preceding day. The worship of the Cows and Bulls continues: all the cattle are decked with flowers, painted horns, &c. and driven about the fields, as if for their amusement.

N. B. For the anniversaries of the accession of the 14 Menus, see Text, page 311.

## ERRATA.

#### PREFACE.

#### Page, Line.

- iii 4 from the top, for Jyantish, read Jyótish. The same correction in the 3d line from the bottom.
- vii 11 from the top, strike off the full stop . and read;
- ix 2 from the bottom, for Cycles, read Cycle.
- xii 13 from the bottom, for Phanomena, read Phanomena.
- ib. in the same line, for 2h 24m, read 8h 53m or 22g 25v 36p Hindu time.

#### FIRST MEMOIR.

- 11 last word of the page, for Ascendentia, read Antecedentia.
- 17 15 from the top, for at the end of the Tables, read in Appendix iv, page 307.
- 20 1 of the note, for Note, read Appendix ii, page 245.
- 23 5 from the bottom, for Cycle, read Style.
- ib. last line of all, for Cali-yugam 3102, read 903-2.
- 26 7 from the bottom, for Ascendentia, read Antecedentia.
- 29 13 from the bottom, for could, read would.
- 36 23 from the top, for Ascendentia, read Antecedentia.
- 39 11 from the bottom, for let it be, read let be.
- 40 16 from the bottom, for Chronologists, read Chronologers.
- 43 8 from the bottom, for at, read with.
- 45 1 of the note, for Note, read Second Appendix, page 307.
- 54 14 from the top, strike off the comma between "less than, and for; and place it after Rest.
- ib. 17 from the top, for is, read was.

## SECOND MEMOIR.

- 69 last figure in the Table at the bottom, for 25, read 24.
- ib. 7 from the top, for Mulkya, read Muc'hya.
- 70 7 from the top, for Sanyama, read Sangama.
- 71 7 in the note, for Narikas, rend Nazicays.
- ib. last line of the note, for " at the end of the Tables", read of the Volume.
- 73 12 from the bottom, for "Third Memoir", read Appendix to the Second Memoir, page 169.
- 75 14 from the top, for Bhaiava, read Bhalava.
- ib. 8 from the bottom, for lasts, read is.
- ib. last line of all, for third Memoir, read Appendix to the Second Memoir.
- 76 16 from the top, strike off the stop after Mahayug) and of the following word strike off T, and read the.
- 77 11 from the top, for Keta, read Ketu.
- 81 12 from the bottom, for Memoirs, read Memoir.
- 86 8 of the note, for Notation, read Natution.
- ib. last line but one of the note, for Epycicular, read Epicircular.
- 2 at top, for "and the Amavasya", read and the ends of the Amavasya, and Prathama Tithis.
- 90 14 from the top, insert 45s over the quantity 28s 45v 32p and read thus 45s

ji Errata.

Page, Line.

- 9.1 7 from the top, for "let it be," read let be.
- 103 last line of all, the same correction.
- 104 last note, for Booja, read Bhuja.
- 115 4 of the article C, after "the Sun and Moon's," add relative (revolutions).
- 117 1 in the note, strike off Amavasya.
- 124 in the marginal note, for Moon, read Sun.
- 127 9 from the top, for Equation, read Motion.
- 130 4 from the bottom, for Malasyan, read Malayala.
- 142 3 from the top, strike off I.
- 153 8 of Article 2, for these, read those.
- 158 last line but one, for "the time that will elapsed", read the fime that will have clapsed.

#### APPENDIX TO THE SECOND MEMOIR.

171 4 from the top, for Josela Barcajosey, read Josela Bascarjosey.

#### THIRD MEMOIR.

- 197 13 from the top, for precedes, read precede.
- ib. 15 from the top, for those of the two, read one of the two.
- ib. 4 from the bottom, for inspection, read analogy.
- 199 10 from the top, at the beginning, strike off 24s.
- 200 7 from the top, for " will be," read was.
- 201 2 from the top, for 353d 17g 10v 31p, read 353d 27g 10v 31p.
- 204 1 of the note, for Suda, read Sucla.
- 215 13 from the bottom, after of the Cali-yug, add be proposed.

## FOURTH MEMOIR.

220 in the note, for page 22 infra, read page 232.

#### APPENDIX II.

- 246 13 from the top, for Chronologist, read Chronologer.
- 247 3 from the top, for invention, read inventor.
- 255 3 from the bottom, in the sum of the Sun's mean Longitude, for 0' 35' 0' 52,9, read 0' 18° 0' 52,9.
- 267 5 of proposition C, from the equation at the end, strike off = the sign of equality, and substitute ~ that of ratio.
- 274 in the note, last line of figures, for T = 26d 8g (56, read 26d 8g Ov 56p.
- ib. last line of the note, after "which is the same as above", add "vine page 273."
- 279 in the computation of the Sun's apparent Longitude, at the bottom, wherever the word Notation appears, read Nutation.

#### APPENDIX III.

- 1 at the top, at its beginning, for "the last of which is always of 355 days, read "Eleven of which are always of 355 days."
- ib. wherever the words Yerdegird, and Yerdegirdic appears in this page, read Yezdegird and Yezdegirdic.
- ib. 18 from the top, for revolutions, read account.
- 298 4 from the bottom, for Chronologist, read Chronologer.
- 299 7 from the top, for Marshervam, read Marshesvam.
- 302 8 from the top, for Snidas, read Suidas.
- 304 6 from the bottom, for "il freit", read il fait.
- ib. 5 from the bottom, for l'au, read l'an.

ERRATA. iii

#### APPENDIX IV.

Page Line.

- 307 3 of the first paragraph, for "amount to six hours of time", read "amount to nearly NINE hours of time."
- 309 14 from the top, at the end, for " before A", read behind A.
- 318 in the heading of the second column of the Kalendar, for " or Chaitram", read " or Bengal Chaitra."

#### FRAGMENT I.

325 1 of the third paragraph, for combats, read combates.

ib. 8 from the bottom, at the end, for "it proceeds 3"  $\frac{3}{4}$  to 3"  $\frac{3}{4}$ ", read "it proceeds from 3"  $\frac{3}{4}$  to 3"  $\frac{3}{4}$ ."

329 3 from the top, near the end, for "it is constructed", read "it was constructed."

#### FRAGMENT IV.

- 2 & 3 of Article I, to "4926, of the Cali yug, and the 1747th since the birth of Sali. "vahana", add "elopsed; the current years being 4927th of the Cali yug, and "1748th Saca."
- 339 4 from the top, for the Sun's mean motion, read the Moon's mean motion.
- 347 In the line of Digits, for 12' 30", read 12' 30', and the same of the two other quantities.

#### ASTRONOMICAL TABLES.

- 2 Table II, in the last line of the last paragraph, for notation, read account.
- 19 Table XVII, 1st and 2d line of the title, for corresponding, read relatively.
- 31 Table XXVI, for the word Druva inserted in the headings of the second columns of the Table, read P'hula.
- 33 Table XXVII, Part 1, in the second line after the Table, for "origin Chaitram," read "origin of Chaitram."
- ib. 7th line do. for " of initial root", read " of the initial root."
- 34 Table XXVII, Part 2, second line of the title, strike off and.
- 44 Table XXXIII, in the body of the Table, after Benares, the Hindu name Cassi of that city should be inserted; and for the same reason, after Oogein, should appear Ujani.
- 65 Table XLIX, last line of all, after the words "civil reckoning", add "the difference 21s" 25' 48p (8b 34' 19", 2 E. T.) being only a fraction of the current day."

#### CHRONOLOGICAL TABLES.

Line.

- v 15 from the top, for "address himself to", read address himself.
- vii 18 from the bottom, for "on the 10th of April at 51' 15", read "on the 10th April " (and Column XI) at 51' 15"."
- ix 2 from the top, at the beginning, for "11th April," read "(according to Dr. Wilson's communication) 12 h April."
- xiii 15 from the top, for "or in the latter supposition", read "but in the latter supposition."
- xx 4 from the top, for "as we find an asterisk", read "as we find a B.

N. B .- For the Errata in the spelling of the Sanscrit terms, see the Glossary.



|   |   |   |   | • |
|---|---|---|---|---|
|   |   |   |   |   |
| • |   |   | - | æ |
|   |   |   |   |   |
|   |   |   |   | - |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   | • |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   | , |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   |   |   |   |
|   |   | - |   |   |
|   |   | • |   |   |

## ASTRONOMICAL TABLES

REFERRED TO IN THE

# KALA SANKALITA.

|   |    | • |  |
|---|----|---|--|
|   |    | × |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
| • |    |   |  |
|   |    |   |  |
|   |    | • |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    |   |  |
|   |    | • |  |
|   | •. |   |  |

TABLE I.

For finding the Initial Feria, and Sydereal beginning of any Solar Year, according to the Tamul Kalendar: the duration of the year (that of the Ariah Siddhanta) being 365d 155 31v 15p.

Vuchij.

| •      | Cali yug.<br>4802          | Roots.     |             |                 |          | Cali yug. Roots. To be used with an Epoch. |          |     |      |     |      | To be used with an Epoch. |        |  |  |  |  |
|--------|----------------------------|------------|-------------|-----------------|----------|--------------------------------------------|----------|-----|------|-----|------|---------------------------|--------|--|--|--|--|
| Druv2, | Epoch or Druva. A. D. 1700 | р.<br>(6)  | c.<br>2     | <b>▼.</b><br>11 | г.<br>15 | Secular<br>years.                          | Roots.   |     |      |     |      |                           |        |  |  |  |  |
|        | Roots 1                    | (1)        | 15          | 31              | 15       | 100                                        | (6)      | 52  | 5    | 0   |      |                           |        |  |  |  |  |
|        | 2                          | (2)        | 31          | 2               | 30       | 200                                        | (6)      | 44  | 10   | 0   |      |                           |        |  |  |  |  |
|        | 3                          | (3)        | 46          | 33              | 45       | 300                                        | (6)      | 36  | 15 • | 0   | 1    |                           |        |  |  |  |  |
|        | 4                          | (5)        | 2           | 5               | 0        | 400                                        | (6)      | 28  | 20   | 0   | İ    |                           |        |  |  |  |  |
|        | 5                          | (6)        | 17          | 36              | 15       | 500                                        | (6)      | 20  | 25   | 0   |      |                           |        |  |  |  |  |
|        | 6                          | (0)        | 33          | 7               | 30       | 600                                        | (6)      | 12  | 30   | 0   | 1    |                           |        |  |  |  |  |
|        | 7                          | (1)        | 48          | 38              | 45       | 700                                        | (6)      | 4   | 35   | 0   | Ì    |                           |        |  |  |  |  |
| •      | 8                          | (3)        | 4           | 10              | 0        | 800                                        | (5)      | 56  | 40   | 0   | ĺ    |                           |        |  |  |  |  |
|        | 9                          | (4)        | 19          | 41              | 15       | 900                                        | (5)      | 48  | 45   | 0   |      |                           |        |  |  |  |  |
|        | 10                         | (5)        | 35          | 12              | 30       | 1000                                       | (5)      | 40  | 50   | 0   | į    |                           |        |  |  |  |  |
|        | 20                         | (4)        | 10          | 25              | 0        |                                            | <u></u>  |     |      |     | -    |                           |        |  |  |  |  |
|        | 30                         | (2)        | 45          | 37              | 30       |                                            |          | Ex  | AMPL | E.  |      |                           |        |  |  |  |  |
|        | 40                         | (1)        | 20          | 50              | 0        | For the                                    | vear of  |     |      |     | 847  | curr                      | ent or |  |  |  |  |
|        | 50                         | (1)        | 56          | 2               | 30       | A. D. 17                                   |          |     |      | Ď.  | G.   | ▼.                        | P.     |  |  |  |  |
|        | 60                         | (6)<br>(5) | 31          | 15              | 0        |                                            | och for  | 170 | 00   | (6) | 2    | 11                        | 15     |  |  |  |  |
|        | 70                         |            | 6           | 27              | 30       |                                            | oot for  |     |      | (1) | 20   | 50                        | 0      |  |  |  |  |
|        |                            | (4)        | <del></del> |                 |          |                                            | o. for   |     |      | (5) |      | 5                         | 0      |  |  |  |  |
|        | 80                         | (2)        | 41          | 40              | 0        |                                            |          |     | Root | (5) | 95   | 6                         | 15     |  |  |  |  |
|        | 90                         | (1)        | 16          | 52              | 30       | mbish Da                                   | at (E) : |     |      |     |      | _                         |        |  |  |  |  |
|        | 100                        | (6)        | 52          | 5               | 0        | which Roc<br> -i. e. Fric                  |          |     |      |     | 1101 | u JZ                      | muuy,  |  |  |  |  |

N. B.—If the beginning of the year 1700 be required—

## TABLE II.

For finding the Initial Feria or Soota dina and Sydereal beginning of the Solar years of the Cycle of 90 years, called Grahaparivrithi, as used in the Southern Provinces of the Peninsula, the year being of 365d 155 31v 30p that of the Vakia Carana.

Sittandij.

For the beginning of the year Cm. 4847 (1745.)

| •                                              | 1                    |                                      |                      |                                      | -                          |
|------------------------------------------------|----------------------|--------------------------------------|----------------------|--------------------------------------|----------------------------|
| First Tpech<br>or Achu                         | Epochs               | of Cycles.                           | Roots                | of Years.                            | oi<br>fo                   |
| A Cali yuz 3078 complete; or A.Ante Chris. 24. | Cycles.              | Epochs.                              | Years.               | Roots.                               | i<br>i                     |
|                                                | 0<br>1<br>2          | D. G.<br>(6) 4<br>(0) 19<br>(1) 36   | 0 1 2                | <b>b.</b> G. (0) 0 (1) 19 (2) 31     |                            |
| ,                                              | 3<br>4               | (2) 53<br>(4) 10                     | 3<br>4               | (3) 47<br>(5) 2                      |                            |
|                                                | 5<br>6<br>7<br>8     | (5) 27<br>(6) 44<br>(1) 1<br>(2) 18  | 5<br>6<br>7<br>8     | (6) 18<br>(0) 33<br>(1) 49<br>(3) 4  |                            |
|                                                | 9<br>10<br>11<br>12  | (3) 35<br>(4) 52<br>(6) 9<br>(0) 26  | 9<br>10<br>20<br>30  | (4) 20<br>(5) 35<br>(4) 10<br>(2) 45 | w<br>B                     |
|                                                | 13<br>14<br>15<br>16 | (1) 43<br>(3) 0<br>(4) 17<br>(5) 34  | 40<br>50<br>60<br>70 | (1) 21<br>(6) 56<br>(5) 31<br>(4) 6  | of<br>da<br>af<br>le<br>Si |
|                                                | 17<br>18<br>19<br>20 | (6) 51<br>(1) 8<br>(2) 25<br>(3) 42  | 90<br>80             | (2) 42<br>(1) 17                     | ar                         |
|                                                | 21<br>22<br>23<br>24 | (4) 59<br>(6) 16<br>(0) 33<br>(1) 50 |                      |                                      |                            |

#### EXAMPLE

of the Calculus, according to the Sittandij, for the year Cali yug 4847 current or A. D. 1745.

To determine the Cycle.

90)1744(19

31

add 24

58 Answer, 19th Cycle 58th year.

#### RULE.

|                   | D.  | (₹. |  |
|-------------------|-----|-----|--|
| Epoch Cycle 19    | (2) | 25  |  |
| Root for years 50 | (6) | 56  |  |
| Ditto for 8       | (3) | 4   |  |

Epoch (5) 25 0 which being an even year, add + , 31

Beginning of year & Chait. (5) 25 31

From which it appears that the beginning of the year and Chaitram falls after the 5th day from Sunday, i. e. Friday, at 25g 31v after Sun rise, which fraction of day being less than 30 guddias; marks the time before Sun set (at Lanca), and in this case the Civil and Sydereal notation agree.

|                          |         |          |   |   |   |   | D,          | G. | ▼. | P. |
|--------------------------|---------|----------|---|---|---|---|-------------|----|----|----|
| According to the Vachij, | ,.<br># | <b>=</b> | Ē | - | ÷ | • | <b>(</b> 5) | 25 | 6  | 15 |
| to the Sittandij         |         | -        | - |   | - | - | (5)         | 25 | 31 | 0  |
| Difference               | •       |          |   |   |   |   | ,,          | ,, | 24 | 45 |

TABLE III.

Exhibiting the Tamul names of the Solar months; their absolute duration; their Roots; and the corresponding Signs of the Zodiac.

|          |                                                          | European months,                                                                                               | April<br>May<br>June<br>July                                               | August<br>Sept.<br>Oct.<br>Nov.                                 | Dec.<br>Jan.<br>Feb.<br>March.                           |                                          |                                                    |
|----------|----------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------------|----------------------------------------------------------|------------------------------------------|----------------------------------------------------|
| r taken. | Names of the Hindu months of the As-<br>tronomical year. | Vaisacha<br>Jaish'ta<br>Ashar<br>Sravana                                                                       | Bha'dra<br>Aswina<br>Cartiga<br>Margasiras                                 | Paushya<br>Wagh<br>Phalguna<br>Chitra                           |                                                          |                                          |                                                    |
|          | ollectively                                              | Names of the Hindu Signs of the Zodiac.                                                                        | 1 Mésha Vaisa<br>2 Vrisha Jaish'<br>3 Mid'huna Ashar<br>5 Carcáta Sravat   | 6 Sinha<br>7 Canya<br>8 Tulà<br>10 Vrischica                    | 11 Dhanus<br>12 Macara<br>13 Cumbha<br>15 Min            |                                          |                                                    |
| III.     | n Months                                                 | This division to be used for finding at once the beginning of mouths when that of the year has been found.     | 6. v. P. 119 41 2 119 42 3 3 21 34 56 22 3                                 | 26 44 6<br>54 6 7<br>48 13 8<br>18 37 10                        | 39 30 11<br>6 46 12<br>55 10 13<br>15 31 15              |                                          |                                                    |
|          | ndia                                                     | This to be findit the lof when when the been                                                                   |                                                                            | ®£©£                                                            | <b>€</b> €€€                                             |                                          |                                                    |
|          | Roots of J                                               |                                                                                                                | Roots of Trpes of Signs and correspon- ding months of the Europear Zodiac. | Types of Signs and corresponding months of the European Zodiac. | B April<br>II May<br>D June<br>A July                    | m August September ni October † November | vs December<br>ss January<br>K February<br>r March |
|          |                                                          | Types of Signs of the Hindu Zodiac.                                                                            | - × × = θ                                                                  | CS 통식 토                                                         | * \$                                                     |                                          |                                                    |
|          | taken. The Hindus as. sign 1864 21h 38' 21'' of our      | The Hindus assign 1864 21h 38' 24" of our line for the Sun to move thro' the N. S. & 1784 8h 3.f. 6" the S. S. | D. c. v. r<br>(2) 55 32 1<br>(3) 24 12 1<br>(3) 36 38 1<br>(3) 28 12 2     | (3) 2 10 1<br>(2) 27 22 1<br>(1) 54 7 1<br>(1) 30 24 2          | (1) 20 53 1<br>(1) 27 16 1<br>(1) 48 24 1<br>(2) 20 21 2 |                                          |                                                    |
| =        |                                                          | ts of Indian<br>separately                                                                                     | ots of India<br>separately                                                 | Tamul months.                                                   | Chaitram (Viassei (Auni Audi                             | Auvani<br>Paratasi<br>Arpesi<br>Cartiga  | Margali<br>Tye<br>Maussi<br>Poongoni               |
|          | Roo                                                      | European Months.                                                                                               | April<br>May<br>June<br>July                                               | August<br>Sept.<br>Oct.<br>Nov.                                 | Dec.<br>Jan.<br>Feb.<br>March                            |                                          |                                                    |
| •        | Time ascribed to each Sign.                              | The Longitude of the 1st of Mesha corresponding with the taken 18° 11′ 26″ A. C. 4847 (1745.)                  | 0. 6. V. F. 30 55 32 1 31 24 12 1 31 28 12 2 2 2 31 28 12 2 2              | 31 2 10 1<br>30 27 22 1<br>29 54 7 1<br>29 30 24 2              | 29 20 53 1<br>29 27 16 1<br>29 48 24 1<br>30 20 21 2     |                                          |                                                    |
| H        | e ascribed                                               | Tamul Months corresponding with 12 Signs of the Zodiac.                                                        | Chaitram<br>Viassei<br>Auni<br>Audi                                        | Auvani<br>Paratasi<br>Arpesi<br>Cartiga                         | Margali<br>Tye<br>Maussi<br>Poongoni                     |                                          |                                                    |
|          | Tim                                                      | Types of Signs of the Hindu Zodinc.                                                                            | B ⊏α⊰                                                                      | CS B 시 트                                                        | <b>↔</b> \$ 11 ×                                         |                                          |                                                    |
|          | •<br>uths                                                | Eurepean mo<br>Old Style                                                                                       | March<br>April<br>May<br>June                                              | July<br>August<br>Sept.                                         | Nov<br>Dec.<br>Jan.<br>Feb.                              |                                          |                                                    |

Style is March.-In that case, taking out the Root to get the beginning of the 2d month in the year, instead of taking that for April (2) Particular attention is to be paid to the European month which concurs with Chaitram, which in present times is April, N. S. but in Old 50 32 1, which is the first in the column, you are to take the same as for March. How to find the beginning of any month in the year, by means of Table I and III.

#### EXAMPLE.

Having found by the Rule given at the foot of Table I, the manner of determining the 1st of Chaitram and year, according to the Vachij; and the same Table II, according to the Sittandij, let the 1st of the Tamul month Paratasi (Indian September) be required.

#### RULE.

| Vachij.                               | Sittandij.                  |             |    |    |    |
|---------------------------------------|-----------------------------|-------------|----|----|----|
| Beginning of p. g. v. p.              |                             | D.          | G. | ٧, | P. |
| Chaitram and year (5) 25 6 15         | Annual Epoch                | <b>(</b> 5) | 25 | 31 | 0  |
| Root Table III,                       |                             |             |    |    |    |
| part 3d, for Auvani (preceding month) |                             |             |    |    |    |
| complete, N. S. (2) 26 44 6           | Root Table III, part 3d,    | (2)         | 26 | 44 | 6  |
| Beginning of Paratasi (0) 51 50 21    | Indian September<br>Sunday. | (0)         | 52 | 15 | 6  |

But if we use the 2d part of Table III, instead of part 3d, we would have to begin from the month of Chaitram, and in order to reach the proposed Epoch to sum up successively the Roots for every month up to that of Paratasi.

|                                             | Exam | PLE. |                       |       | New Style.                   |
|---------------------------------------------|------|------|-----------------------|-------|------------------------------|
| Beginning of Chaitram at Root for Chaitram, |      | 7    | <b>(</b> 5) <b>25</b> |       |                              |
| Beginning of Viassei,<br>Root for Viassei,  | -    | •    | (1) 20<br>(3) 24      |       | May<br>for June              |
| Beginning of Auni,<br>Root for Auni,        | -    | -    | (4) 44<br>(3) 36      |       | June<br>for Jul <del>y</del> |
| Beginning of Audi,<br>Root for Audi,        | -    |      | (1) 21<br>(3) 28      |       | July for August              |
| Beginning of Auvani,<br>Root for Auvani,    | ~ ~  | -    |                       |       | August<br>for September      |
| August.—Beginning of Paratasi,              | -    | -    | (0) 51                | 50 21 | September.                   |

The same as before.

It need hardly be observed, that the beginning of the ensuing year may be obtained by going on adding the Roots as far as the month Poongoni.

TABLE IV.

For converting European hours, minutes and seconds, into Hindu guddias, viguddias, paras, suras; and vice versa.

| Europea           | European hours, minutes and seconds into Hindu Time. |            |                   |       |            |     |                | Hindu guddias, viguddias and paras into<br>European Time. |             |                |             |             |  |  |
|-------------------|------------------------------------------------------|------------|-------------------|-------|------------|-----|----------------|-----------------------------------------------------------|-------------|----------------|-------------|-------------|--|--|
| European<br>Time. | _                                                    | ndu<br>ne. | European<br>Time. |       | ndu<br>me. |     | Hindu<br>Time. |                                                           | pean<br>me. | Hindu<br>Time. | Euro<br>Tit | pean<br>ne. |  |  |
| н.                | G.                                                   | v.         | н.                | DAY   | 8. G.      |     | G,             | н.                                                        | Mi.         | G.             | н.          | м.          |  |  |
| m.s.              | ▼. p.                                                | p. s.      |                   | g, v. | v. p.      |     | v. p.          | m.s.                                                      |             | v. p.          | m. s.       |             |  |  |
| 1 1               | 2                                                    | 30         | 10                | 0     | 25         | Ì   | 1              | 0                                                         | 24          | 10             | 4           | 0           |  |  |
| 2                 | 5                                                    | 0          | 20                | 0     | 50         | - 1 | $\frac{2}{3}$  | 0                                                         | 48          | 20             | 8           | 0           |  |  |
| 3                 | 7                                                    | 30<br>     | 30                | 1     | 15         |     |                | 1                                                         | 12          | 30             | 12          | 0           |  |  |
| 4                 | 10                                                   | 0          | 40                | 1     | 40         | -   | 4              | 1                                                         | 36          | 40             | 16          | 0           |  |  |
| 5                 | 12                                                   | 30         | 50                | 2     | 5          | ļ   | 5              | 2                                                         | 0           | 50             | 20          | 0           |  |  |
| 6                 | 15                                                   | 0          | 60                | 2     | 30         | j   | 6              | 2                                                         | 24          | 60             | 24          | 0           |  |  |
| 7                 | 17                                                   | 30         |                   |       |            | Ì   | 7              | 2                                                         | 48          | •              |             |             |  |  |
| 8                 | 20                                                   | 0          | 1                 |       | - 1        |     | 8              | 3                                                         | 12          | 1              | ]           |             |  |  |
| 9                 | 21                                                   | 30         |                   |       |            |     | 9              | 3                                                         | 36          |                |             |             |  |  |
| 10                | 25                                                   | 0          |                   |       | }          | i   | 10             | 4                                                         | 0           |                | Į           |             |  |  |

The use of this Table is familiar to all Mathematicians. I shall, however, give two Examples of its application.

|    |         | $\mathbf{E}$ | XAME | LE  | I.   |       |       |
|----|---------|--------------|------|-----|------|-------|-------|
| To | convert | 15h          | 21m  | 35s | into | Hindu | time. |
|    |         |              |      | -   |      | _     | _     |

|           |            | G.              | v. | P. | s. |
|-----------|------------|-----------------|----|----|----|
| Part 1st, | 10h        | <del>二</del> 25 |    |    |    |
| ,         |            | =12             | 30 |    |    |
|           | 20m        | =               | 50 |    |    |
|           | 1 m        | =               | 2  | 30 |    |
|           | 305        | =               | 1  | 15 |    |
|           | <b>5</b> s | ==              |    | 12 | 30 |
| Answer    | -          | 38              | 23 | 57 | 30 |
|           |            | _               |    |    |    |

Example II.

To convert 56° 37° 23° into European Time.

TABLE V.

For finding the Dominical Letter, Julian and Gregorian accounts.

Parts First and Second.

|                   |                                          | Pa                                                                                   | rt 1st | , Juliar                                        | ı Secu           | lar yea                          | rs.                                                                                  |    |                                             | Part 2d.                                                                             |                |                                                 |
|-------------------|------------------------------------------|--------------------------------------------------------------------------------------|--------|-------------------------------------------------|------------------|----------------------------------|--------------------------------------------------------------------------------------|----|---------------------------------------------|--------------------------------------------------------------------------------------|----------------|-------------------------------------------------|
| 1                 | 2                                        | 3                                                                                    | 4      | 5                                               | 1 1              | 2                                | 3                                                                                    | 4  | 5                                           | 1                                                                                    | 2              | 3                                               |
| Years of Æra Cali | Concurrent Christian Secular years O. S. | Days of<br>the week<br>beginning<br>each<br>Christian<br>century<br>Julian<br>Style. |        | Beginning of concur-<br>rent year Call yng O.S. | Year of Ara Cali | Concurrent Christian years O. S. | Days of<br>the week<br>beginning<br>each<br>Christian<br>century<br>Julian<br>Style. |    | Beginning of concurrently ear Cali yug 0.8. | Days of<br>the week<br>beginning<br>each<br>Christian<br>century<br>Gregorian Style. | ominical N. S. | Beginning of concur-<br>tent year Cali yug N.S. |
|                   | A. D.                                    |                                                                                      |        | March.                                          |                  | A. D.                            |                                                                                      |    | March                                       |                                                                                      |                |                                                 |
| 3102              |                                          | Thursday                                                                             | DC     | 14                                              | 1202             | 1100                             | Sunday                                                                               | AG | 23                                          |                                                                                      |                |                                                 |
| 3202              |                                          | Wednes                                                                               | ED     | 14                                              | 4302             |                                  | Saturday                                                                             | BA | 24                                          | 1                                                                                    | 1              |                                                 |
| 3302              |                                          | Tuesday                                                                              | FE     | 15                                              | 1402             |                                  | Friday                                                                               | CB | 25                                          | 1                                                                                    | 1              |                                                 |
| 3402              | 300                                      | Monday                                                                               | GF     | 16                                              | 1502             | 1400                             | Thursday                                                                             | DC | 26                                          | l 1                                                                                  |                | l                                               |
| 1                 | 400                                      | \ <del></del>                                                                        | 1      |                                                 | 1                |                                  |                                                                                      |    |                                             |                                                                                      | _              | April.                                          |
| 3502<br>3602      |                                          | Sunday<br>Saturday                                                                   | AG     | 17                                              | 4602             |                                  | Wednes                                                                               | ED | 27                                          | Monday                                                                               | G              | 5                                               |
| 3702              |                                          | Friday                                                                               | BA     | 19                                              | 4702<br>  4802   | 1700                             | Tuesday<br>Monday                                                                    | FE | 27                                          | Saturday                                                                             | BA             | 6<br>8                                          |
| 3802              | 1 '                                      | Thursday                                                                             |        | 20                                              | 4902             | 1800                             | Sunday                                                                               | GF | 28<br>29                                    | Friday                                                                               | C<br>E         | 10                                              |
| 3602              | 1 700_                                   | Liuisuay                                                                             |        | 1 20                                            | 1902             | 1000                             | Januay                                                                               | AG | 29                                          | Wednes                                                                               | F.             | 10                                              |
| 3902              | 800                                      | Wednes                                                                               | ED     | 20                                              | 5002             | 1900                             | Saturday                                                                             | BA | 30                                          | Morday                                                                               | G              | 12                                              |
| 4002              | 1                                        | Tuesday                                                                              | FE     | 21                                              | 5102             |                                  | Friday                                                                               | CB |                                             | Saturday                                                                             | BA             | 13                                              |
| 4102              | 1000                                     | Monday                                                                               | GF     | 22                                              | il               | 1                                | 1                                                                                    | -  |                                             |                                                                                      |                |                                                 |

## HEADS OF THE COLUMNS.

#### Part First.

- 1. Tamul Solar years counted from Epoch Cali yugam current.
- 2. Christian Secular Julian years concurrent with the same.
- 3. Days of the week beginning each Christian century according to the Julian Kalendar.
- 4. Dominical Letters of Christian Secular years O. S.
- 5. Date on which the concurrent Tamul year begins according to the Julian Kalendar.

#### Part Second.

- 1. Days of the week on which the Christian century begins according to the Gregorian Kalendar.
- 2. Dominical Letters of Christian Secular years N. S.
- 3. Date on which the concurrent Tamul year begins according to the Gregorian Kalendar.

TABLE V.
PART THE THIRD.

|                                          |                              | Julian Se                        | cular years.              |                                                                             |                    |
|------------------------------------------|------------------------------|----------------------------------|---------------------------|-----------------------------------------------------------------------------|--------------------|
| 1                                        | 2                            | 3                                | 4                         | 5                                                                           | 6                  |
| Anno Ante Anno<br>Christian Æra. Mundi.  |                              | Anno from the Epoch Cali yu-gam. | Dominical<br>Letter O. S. | Day of the week be-<br>ginning each Chris-<br>tian century Julian<br>Style. |                    |
| 4001<br>4000                             | 1 (*)<br>4                   | Ante Cali yug. —903.2 —898.7     | DC<br>FE                  | Thursday<br>Tuesday                                                         | February<br>8<br>8 |
| <b>3</b> 000<br><b>2</b> 000             | 1004<br>2004                 | Post Cali yug.<br>+ 102<br>1102  | BA<br>ED                  | Saturday<br>Wednesday                                                       | 16<br><b>2</b> 5   |
| 1000<br>900<br>800<br>700                | 3004<br>3104<br>3204<br>3304 | 2102<br>2202<br>2302<br>2402     | AG<br>BA<br>CB<br>DC      | Sunday<br>Saturday<br>Friday<br>Thursday                                    | March 5 6 7 7      |
| 600<br>500<br>400<br><b>3</b> 0 <b>0</b> | 3404<br>3504<br>3604<br>3701 | 2502<br>2602<br>2702<br>2802     | ED<br>FE<br>GF<br>AG      | Wednesday<br>Tuesday<br>Monday<br>Sunday                                    | 8<br>9<br>10<br>11 |
| 200<br>100<br>0                          | 3804<br>3904<br>4004         | 2902<br>3002<br>3102             | BA<br>CB<br>DC            | Saturday<br>Friday<br>Thursday                                              | 12<br>13<br>14     |

SUPPLEMENT.

| Julian Secular       | Domini-        | Julian Secular       | Dominical Letter O. S. | Julian Secular       | Domini-        | Julian Secular | Domini-   |
|----------------------|----------------|----------------------|------------------------|----------------------|----------------|----------------|-----------|
| years from           | cal Let-       | years from           |                        | years from           | cal Let        | years from     | cal Let-  |
| A. A. C.1000.        | ter O. S.      | A. A. C. 1000        |                        | A. A. C. 1000        | ter O. S.      | A. A. C. 1000. | ter O. S. |
| 4000                 | FE             | 3100                 | AG                     | <b>2</b> 200         | CB             | 1300           | ED        |
| 3900                 | GF             | 3000                 | BA                     | 2100                 | DC             | 1200           | FE        |
| 3800                 | AG             | 2900                 | CB                     | 2000                 | ED             | 1100           | GF        |
| 3700<br>3600<br>3500 | BA<br>CB<br>DC | 2800<br>2700<br>2600 | DC<br>ED<br>FE         | 1900<br>1800<br>1700 | FE<br>GF<br>AG | 1000           | AG        |
| 3400<br>3300<br>3200 | ED<br>FE<br>GF | 2500<br>2400<br>2300 | GF<br>AG<br>BA         | 1600<br>1500<br>1400 | BA<br>CB<br>DC |                |           |

<sup>(\*)</sup> Port Royal account.

TABLE VI.

For finding the feria or weekly day which begins any proposed year.

This Table is always to be entered with the odd Christian year current of the century.

|        | Par    | t 1st, | Julia                    | n Sty  | le.        |                          |
|--------|--------|--------|--------------------------|--------|------------|--------------------------|
| of the | e weel | k begi | to be<br>inning<br>eekly | the (  | Centu      | e day<br>ry for<br>given |
| 0      | 1      | 2      | 3                        | 4      | 5          | 6                        |
|        | Odo    | l year | s of C                   | Centui | ies.       |                          |
| *      | 0 1    | 1      | 2 1                      | 3      | 4          | 10                       |
| 5      | 6      | 7      | 8                        | 14     | 9          | 16                       |
| 11     | 12     | 18     | 13                       | 20     | 15         | 21                       |
| 22     | 17     | 24     | 19                       | 25     | 26         | 27                       |
| 28     | 23     | 29     | 30                       | 31     | 3 <b>2</b> | 38                       |
| 33     | 34     | 35     | 36                       | 42     | 37         | 44                       |
| 39     | 40     | 46     | 41                       | 48     | 43         | 49                       |
| 50     | 45     | 52     | 47                       | 53     | 54         | 55                       |
| 56     | 51     | 57.    | 58                       | 59     | 60         | 66                       |
| 61     | 62     | 63     | 64                       | 70     | 65         | 72                       |
| 67     | 68     | 74     | 69                       | 76     | 71         | 77                       |
| 78     | 73     | 80     | 75                       | 81     | 82         | ১৪                       |
| 84     | 79     | 85     | 86                       | 87     | 88         | 91                       |
| 89     | 90     | 91     | 92                       | 98     | 93         | 100                      |
| 95     | 96     | l      | 97                       |        | 99         | 1                        |

|                  | Part   | 2d, (           | rego   | ian s      | tyle.                       |       |
|------------------|--------|-----------------|--------|------------|-----------------------------|-------|
| of the<br>findin | e weel | k begi<br>1st w | aning  | the (      | d to th<br>Centur<br>in the | y for |
| 0                | 1      | 2               | 3      | 4          | 5                           | 6     |
|                  | Ode    | d year          | s of C | Centui     | ries.                       |       |
| 0                | 1      | 2               | 3      | 4          | 10                          | 5     |
| 6                | 7      | 8               | 14     | 9          | 16                          | 11    |
| 12               | 18     | 13              | 2)     | 15         | 21                          | 22    |
| 17               | 24     | 19              | 25     | 26         | 27                          | 28    |
| 23               | 29     | 30              | 31     | 3 <b>2</b> | 38                          | 33    |
| 31               | 35     | <b>3</b> 5      | 42     | 37         | 44                          | 39    |
| 40               | 46     | 41              | 48     | 43         | 49                          | 50    |
| 45               | 52     | 47              | 53     | 54         | 55                          | 56    |
| 51               | 57     | 58              | 59     | 60         | 66                          | 61    |
| 62               | 63     | 64              | 70     | 65         | 72                          | 67    |
| 68               | 74     | 69              | 76     | 71         | 177                         | 78    |
| 73               | 80     | 75              | 81     | 82         | 83                          | 84    |
| 79               | 85     | 86              | 87     | 88         | 94                          | 89    |
| 90               | 91     | 92              | 98     | 93         | 100                         | 95    |
| 96               |        | 97              |        | 99         | ı                           | I     |

The construction and use of this Table are explained in the first Memoir. It is in all cases to be entered with the proposed current odd year of the Century.

For the years before Christ either Part first or second is to be used, as the given year happens to be a bissextile or a common one; a distinction, however, which does not apply to years after Christ.

TABLE VII.

Shewing the Epochs and Roots of Secular years from A. D. 0 to 2000.

| The construction and use of this        |
|-----------------------------------------|
| Table are explained in the first Me-    |
| moir. The manner of using it is the     |
| same as that indicated at the foot of   |
| Table I, where the Epoch for 1700,      |
| marked at the top of the 1st column     |
| (6") 2" 11" 15", is taken for the reso. |
| lution of the beginning of A. Cm.       |
| 4847 (1745).                            |

The 3d column exhibits the proper Roots of the Secular years which indicates at once its beginnings without the subtraction of one year from the Epoch for the same year, which is apt to occasion mistakes.

The Roots for the odd years are to be taken out of Table I.

| 1                             | •                                                         |     | 2          | ;                  |           |            |                      | 3                |                            |
|-------------------------------|-----------------------------------------------------------|-----|------------|--------------------|-----------|------------|----------------------|------------------|----------------------------|
| European<br>Secular<br>years. | Concur-<br>rent years<br>Cali yu-<br>gam com-<br>mencing. | nin | the<br>g c | beg<br>of t<br>Hin | in-<br>he | ame        | dif<br>from<br>the b | fer-<br>n<br>y 1 | Julian<br>date in<br>March |
|                               |                                                           | D.  | G.         | ٧.                 | P.        | D.         | G.                   | ٧.               |                            |
| 0                             | 3102                                                      | (1) | 16         |                    | 15        |            | 1                    | 1 !              | 14                         |
| 100                           | 3202                                                      | (1) | 8          | 51                 | 15        | , , ,      | 53                   | 20               | 14                         |
| 200                           | 3302                                                      | (1) | 0          | 56                 | 15        |            |                      | 25               | 15                         |
| 300                           | 3405                                                      | (0) | 53         | 1                  | 15        | (6)        | 37                   | 30               | 16                         |
| 400                           | 3502                                                      | (0) | 45         | 6                  | 15        | <b>(6)</b> | 29                   | 35               | 17                         |
| 500                           | 3602                                                      | (0) | 3 <b>7</b> | 11                 | 15        | (6)        | 21                   | 40               | 18                         |
| 600                           | 3702                                                      | (0) | 29         | 16                 | 15        | (6)        | 13                   | 45               | 19                         |
| 700                           | 3802                                                      | (0) | 21         | 21                 | 15        |            | 5                    | 50               | 20                         |
| 800                           | 3902                                                      | (0) | 13         | 26                 | 15        | (5)        | 57                   | 55               | 20                         |
| 900                           | 4002                                                      | (0) | 5          |                    | 15        |            | 50                   | 0                | 21                         |
| 1000                          | 4102                                                      | (6) |            |                    | 15        |            | 42                   | 5                |                            |
| 1100                          | 4202                                                      | (6) |            |                    | 15        |            | 34                   | 10               | 23                         |
| 1200                          | 4302                                                      | (6) | 41         | 46                 | 15        | (5)        | 26                   | 15               | 24                         |
| 1300                          | 4402                                                      | (6) | 33         | 51                 |           | (5)        | 18                   | 20               | 25                         |
| 1400                          | 4502                                                      | (6) | 25         | 56                 | 15        |            | 10                   | 25               | 26                         |
| 1500                          | 4602                                                      | (6) | 18         | 1                  | 15        |            | 2                    | 30               | 27                         |
| 1600                          | 4703                                                      | (6) | 10         | 6                  | 15        | (4)        | 54                   | 35               | 27                         |
| 1700                          | 4802                                                      | (6) | 2          | 11                 |           | (4)        |                      | 40               | 28                         |
| 1800                          | 4902                                                      | (5) |            |                    | 15        |            | 38                   | 45               | 29                         |
| 1900                          | 5002                                                      | (5) | 46         | 21                 | 15        |            |                      |                  | 30                         |
| 2000                          | 5102                                                      | (5) | 38         | 26                 | 15        | (4)        | 22                   | 55               | 31                         |

#### EXAMPLE.

Wanted the beginning of A. D. 622, or Cali yugam 3721 (515 Saca).

| By Table VII.<br>Root for 20 ye<br>Do. for 1 yea | are, by | Table | I. | - | . D. 609 .           | (o)<br>(4) | 29<br>10 | 25 | 15<br>0 |
|--------------------------------------------------|---------|-------|----|---|----------------------|------------|----------|----|---------|
| Beginning of                                     |         |       |    |   |                      | `          |          |    |         |
| 545 Saca                                         | -       | •     | -  | • | $oldsymbol{F}$ riday | (5)        | 55       | 12 | 30      |
| •                                                |         |       |    |   | Sucra-v              | ara,       |          |    |         |

The (6) in the 3d column shews at once that the Secular year 3702 Cali yugam (A. D. 600) began on a Saturday, Sani-vara, answering to the 19th March, O. S. both Civil and Sydercal accounts.

TABLE VIII.

PART FIRST.

For years ascending from the birth of Christ, from 0 to 100.

| Years                            | of the Fir            | st Century               | В. С | . asc | endir                    | ıg.        |
|----------------------------------|-----------------------|--------------------------|------|-------|--------------------------|------------|
| Years<br>Ante<br>Christ.<br>Æra. | Anno<br>Mundi.<br>(*) | Anno<br>Cali yu-<br>gam. | the  | hegi  | dicati<br>nning<br>nul y | of         |
|                                  |                       |                          | D.   | G.    | ٧.                       | P.         |
| 100                              | 3904                  | 3002                     | (0)  | 9     | 10                       | 0          |
| 90                               | 3914                  | 3012                     | (5)  | 44    | 22                       | 30         |
| 80                               | 3924                  | 3022                     | (4)  | 19    | 35                       | 0          |
| <b>7</b> 0                       | 3934                  | 3032                     | (2)  | 54    | 45                       | 30         |
| 60                               | 3944                  | 3042                     | (1)  | 30    | 0                        | 0          |
| 50                               | 3954                  | 3052                     | (0)  | 5     | 12                       | <b>3</b> 0 |
| 40                               | 3964                  | 3062                     | (5)  | 40    | 20                       | 0          |
| 30                               | 3974                  | 3072                     | (4)  | 15    | 37                       | <b>3</b> 0 |
| 20                               | 3984.                 | 3082                     | (2)  | 50    | 50                       | 0          |
| 10                               | 3994                  | 3092                     | (1)  | 26    | 2                        | 30         |
| 9                                | 3995                  | 309 <b>3</b>             | (2)  | 41    | 33                       | 45         |
| 8                                | <b>3</b> 996          | 3094                     | (3)  | 57    | 5                        | 0          |
| 7                                | 3997                  | 3095                     | (5)  | 12    | 36                       | 15         |
| 6                                | 3998                  | 3096                     | (6)  | 28    | 7                        | 30         |
| 5                                | <b>3</b> 99 <b>9</b>  | 3097                     | (0)  | 43    | <b>3</b> 8               | <b>4</b> 5 |
| 4                                | 4000                  | 3098                     | (1)  | 59    | 10                       | 0          |
| 3                                | 4001                  | 3099                     | (3)  | 14    | 41                       | 15         |
| 2                                | 4002                  | 3100                     | (4)  | 30    | 12                       | <b>3</b> 0 |
| 1                                | 4003                  | 3101                     | (5)  | 45    | 43                       | 45         |
| 0                                | 4004                  | 3102                     | (0)  | 1     | 15                       | 0          |

The construction and use of this Table are explained in the first Memoir.

Of this Table it is to be observed, that it gives the absolute Root for the beginning of years. That is to say, no Epoch is to be added to the quantity registered, in order to obtain the Sydereal beginning of Chaitram and year falling within its limits.

If the beginning of a year from 10 to 100 B. C. be required, take the Root of the nearest one, and complete it with the Root of the intermediate years out of Table I.

EXAMPLE.

Let the Root for the beginning of the 24th year before Christ be required.

|                                              | D.         | G. | ₹.              | P. |                     |
|----------------------------------------------|------------|----|-----------------|----|---------------------|
| Take Root for 20 years, Table VIII           | (2)        | 50 | 50              | 0  |                     |
|                                              | (5)        | 2  | 5               | 0  |                     |
| Beginning of A. Cm. 3078 (B. C. 24) Thursday | (4)        | 48 | 45              | 0  |                     |
| The same by the Epoch. A. D. O Ep.           | (1)        | 16 | 46              | 15 | Table VIII, part 2. |
| For 20 years, Table 1                        | (4)        |    | 25              |    |                     |
|                                              | <b>(4)</b> | 6  | 21<br><b>36</b> | 15 |                     |
| Do, for 5 years Do.                          | (6)        | 17 | 36              | 15 | 1                   |
| Beginning of Chaitram and year .             | (4)        | 48 | 45              | 0  | the same as before  |
|                                              | -          |    |                 |    |                     |

#### TABLE VIII.

#### PART THE SECOND.

For years ascending from the birth of Christ 0, to that of the Creation, according to the Mosaic system.

|                                   |                              | Years as                                  | cending to the Crea                                                        | ition.                                                    | <del></del>                             |
|-----------------------------------|------------------------------|-------------------------------------------|----------------------------------------------------------------------------|-----------------------------------------------------------|-----------------------------------------|
| Anno<br>Ante<br>Christian<br>Æra. | Anno<br>Mundi.               | Concur-<br>rent years<br>Cali yu-<br>gam. | Epochs of Secular years.                                                   | Roots of Secular years.                                   | Begins<br>of Solar<br>years,<br>Julian. |
| 0                                 | rigin of T                   | (*)<br>ime at Noo                         | n, Sunday.                                                                 | D. G. V. P.<br>(0) 15 50 0                                | Feby.                                   |
| 4004<br>4000<br>3000<br>2000      | 1<br>4<br>1004<br>2004       | 903, 2<br>998, 7<br>102<br>1102           | D. G. V. P.<br>(2) 46 52 30<br>(6) 33 26 15<br>(5) 14 16 15<br>(3) 55 6 15 | (1) 31 21 15<br>(5) 17 55 0<br>(3) 58 45 0<br>(2) 39 35 0 | 8<br>8<br>16<br>25                      |
| 1000<br>900<br>800<br>700         | 3004<br>3104<br>3204<br>3304 | 2102<br>2202<br>2302<br>2402              | (1) \$5 56 15<br>(2) 28 1 15<br>(2) 20 6 15<br>(2) 12 11 15                | (1) 20 25 0<br>(1) 12 30 0<br>(1) 4 35 0<br>(0) 56 40 0   | March 5 6 7 7                           |
| • 600<br>500<br>400<br>300        | 3404<br>3504<br>3604<br>3704 | 2502<br>2602<br>2702<br>2802              | (2) 4 16 15<br>(1) 56 21 15<br>(1) 48 26 15<br>(1) 40 31 15                | (0) 48 45 0<br>(0) 40 50 0<br>(0) 32 55 0<br>(0) 25 0 0   | 8<br>9<br>10<br>11                      |
| 200<br>100<br>0                   | 2804<br>3904<br>4004         | 2902<br>3002<br>3102                      | (1) 32 36 15<br>(1) 24 41 15<br>(1) 16 46 15                               | (0) 17 5 0<br>(0) 9 10 0<br>(0) 1 15 0                    | 12<br>13<br>14                          |

The construction and use of this Table are explained in the last Section of Part 1st of the first Memoir. Its application differs in nothing from that of Table VII, excepting that if the Epochs are used for expounding the beginnings of the Hindu years, one year is to be added instead of subtracted (for having the complete Solar year ending) to the notation of the proposed year; because the years before Christ are noted increasing whilst ascending, as is exemplified in the Rule at the foot of the preceding page.

<sup>(\*)</sup> It may be worth noticing, that in calculating the beginning of the Solar Sydereal year of the Creation according to the Mesaic system, by the Hindu formula, it falls on a Sunday, 8th February, very near noon, the difference being only 20 minutes European time.

TABLE IX.

Exhibiting the Dominical Letter for every duy in the year.

| December                | ~ ≈< ⊃                                          | re G c                                      | #420                                                                  | 2048                                                              | 4 o o o                                          | 0 4 8c4                                                        | e 9 c c                                              | 1 95 A             |
|-------------------------|-------------------------------------------------|---------------------------------------------|-----------------------------------------------------------------------|-------------------------------------------------------------------|--------------------------------------------------|----------------------------------------------------------------|------------------------------------------------------|--------------------|
| Dece                    | - 64 W 44                                       | 5 7 8 8                                     | 100                                                                   | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 22<br>23<br>23<br>24                                           | 25<br>26<br>27<br>28                                 | 930                |
| mber                    | <b>₽ 0 ← 1</b> 0                                | do o b                                      | کید ب                                                                 | ೨೦೦೯                                                              | ~ 85 € C                                         | d<br>f                                                         | 8 Q Q O                                              | e o                |
| November                | -004                                            | 8402                                        | 9<br>10<br>11<br>12                                                   | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 21<br>22<br>23<br>24                                           | 25<br>26<br>27<br>28                                 | 30                 |
| October.                | <b>₹</b> Ωυఌ                                    | o <b></b> 85 <b>⋖</b>                       | e c c c                                                               | 7 88 to                                                           | ು ಇ ಀ ⊷                                          | ಜ∢ರಂ                                                           | ದ ೨೭ ಜ                                               | V o                |
| Octo                    | −000 ¢                                          | 8 7 6 5                                     | 9<br>10<br>11<br>12                                                   | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 21<br>23<br>24<br>24                                           | 25<br>26<br>27<br>28                                 | 30 31              |
| mber                    | + 20 € C                                        | 0000                                        | ge <b>Q</b> a o                                                       | 2048                                                              | V Q O T                                          | ა <b>ყ</b> გგ                                                  | ရ ပေသ                                                | en eu              |
| September               | <b>-</b> €5 <b>60</b> 4                         | 2010                                        | 9<br>10<br>11<br>12                                                   | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 2000                                                           | 25<br>27<br>27<br>28                                 | 20                 |
| August.                 | . J                                             | w <b>∀</b> ⊅ o                              | d<br>r<br>s                                                           | <b>4</b> 000                                                      | 9 7 86 K                                         | e d c                                                          | + 25 C                                               | 000                |
| Aug                     | 1004                                            | 6 2 7 8                                     | 10 10 12 12 12                                                        | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 2222                                                           | 25<br>26<br>27<br>28                                 | 30 30              |
| July.                   | ಜ∢ರು                                            | 2 o 4 g                                     | <b>4</b> 200                                                          | Pro tre                                                           | o<br>o<br>e                                      | f<br>A<br>D                                                    | re d c                                               | # <b>Q</b> 2       |
| Ju                      | -000                                            | 0 7 8                                       | 0 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                               | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 22<br>23<br>24<br>24<br>24                                     | 25<br>26<br>27<br>28                                 | 30<br>31           |
| June.                   | د بـ س≺                                         | و م<br>د م                                  | ್ ಜ <b>∢</b> ರ                                                        | <b>4</b> e C C                                                    | & <b>∀</b> Ω ∪                                   | ದ ಕಿ ನಿ ದ                                                      | Adob.                                                | e 44               |
| Ju                      | - C) 20 4                                       | 8 7 65                                      | 10<br>11<br>12                                                        | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 25<br>25<br>25<br>27<br>27                                     | 25<br>26<br>27<br>28                                 | 30                 |
| May.                    | <b>က</b> ပတ                                     | ₽ ₽ ₽ ₽ ₽                                   | re d                                                                  | ಜನರು                                                              | ರು ಈ ಕು                                          | ور م                                                           | Pag up to                                            | <b>م</b> د ه       |
|                         |                                                 |                                             |                                                                       |                                                                   |                                                  |                                                                |                                                      |                    |
| W                       | ₩ 0; 0; <del>4</del>                            | 8 1 0 2                                     | 9<br>10<br>11<br>12                                                   | 13<br>14<br>15<br>16                                              | 17<br>18<br>19<br>20                             | 21<br>22<br>23<br>24                                           | 25<br>26<br>27<br>28                                 | 29<br>30<br>31     |
| =                       | π <b>Α</b> ⊅ο<br>ου4                            | 1                                           | A 9<br>b 10<br>c 11<br>d 12                                           | <b>В</b> В В В В В В В В В В В В В В В В В В                      | c 18<br>d 19<br>e 20                             | f 21<br>g 22<br>A 23<br>b 24                                   | c 25<br>d 26<br>r 27<br>f 28                         | g 29<br>A 30<br>31 |
| April. Ma               |                                                 | 8 7 6 8                                     |                                                                       |                                                                   | <del></del>                                      |                                                                |                                                      |                    |
| April.                  | ಜ್ಞಾಂ                                           | d f e d 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 | P<br>G<br>G                                                           | 33 ee 1 1 9 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                         | و <b>ت</b> ود م                                  | . 8¢¢o                                                         | 0004                                                 | ૠ.⊄                |
| =                       | =0004<br>≈400                                   | 8 4 4 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8     | 9 A<br>10 b<br>11 c<br>12 d                                           | 13<br>15<br>15<br>16<br><b>A</b>                                  | 17 b<br>18 c<br>19 d<br>20 e                     | 21 t                                                           | 25<br>26<br>27<br>28<br>28<br>27<br>28               | 30 A               |
| March.   April.         | 204<br>1004<br>#400                             | A 5 6 6 6 6 6 6 7 6 7 6 7 6 7 6 8 8 8 8 8   | e 9 A f 10 p c S 11 c A 12 d                                          | 3 b 13 e 14 f 1 1 6 e 1 6 A 1 1 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 | f 17 b 8 18 c A 19 d b 20 e                      | c 21 f 6 20 g 6 F 6 20 g 7 F 7 F 7 F 7 F 7 F 7 F 7 F 7 F 7 F 7 | 8 25 c<br>b 27 d<br>c 28 f                           | d 29 K             |
| February. March. April. | 1 0 0 0 4 B C C C C C C C C C C C C C C C C C C | 5 A 5 d 5 7 7 C 7 f 7 7 8 8 8 8 8 8         | 9 e 9 A<br>10 f 10 b<br>11 g 11 c<br>12 A 12 d                        | 13 b 13 e 1 1 f 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                   | 17 f 17 b<br>18 g 18 c<br>19 A 19 d<br>20 b 20 e | 21 c 21 f<br>22 d 20 g<br>23 e 23 A<br>24 f 24 b               | 25 R 25 c<br>26 A 26 d<br>27 b 27 c<br>28 c 28 f     | d 29 K             |
| March.   April.         | 1 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0         | A 5 A 5 d 5 c c c 7 c f 7 d 8 d 8 g g 8     | c 9 e 9 A g 110 b 111 c q 111 c q q 111 c q q 111 c q q 111 c q q q q | 3 b 13 b 13 e 14 f 1 1 6 e 16 e 16 A 1                            | f 17 f 17 b 18 c A 19 A 19 d b 20 b 20 e         | c 21 c 21 f<br>d 22 d 22 g<br>e 23 e 23 A<br>f 24 f 24 b       | A 25 R 25 C B 27 C C C C C C C C C C C C C C C C C C | d 29 K             |

TABLE X.

Table showing some of the forms assumed by the months of the mean Solar Tanul year, with reference to the Gregorian Style.

| 4918                                                                                               | Number of days<br>in each month.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 88 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8                                       | . 20<br>. 20<br>. 30                                                                                 |
|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------|
| ali yus                                                                                            | Concurrent<br>Christian date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | April<br>May<br>June<br>July<br>Aug<br>Sept<br>Oct<br>Nov                    | 11 Jan<br>10 Feb<br>11 Mar<br>11 April                                                               |
| ၁                                                                                                  | <b>,</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |                                                                              |                                                                                                      |
| The twelve months of the jear Cali yog 4856 The twelve months of the year Cali yug 4915 (1813-14). | Days of the week<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaingenemes<br>gaing<br>gaingenemes<br>gaing<br>gaing<br>gaing<br>gaing<br>gaing<br>gaing<br>gaing<br>g | Sunday<br>fues<br>Satur<br>Tues<br>Satur<br>Tues<br>Thurs<br>Satur<br>Mon    | Tues<br>Thurs<br>Friday<br>Mon                                                                       |
| 181                                                                                                | th of                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 15<br>115<br>115<br>115<br>120<br>220<br>223<br>223                          | 26<br>27<br>28<br>28<br>30                                                                           |
| eth (                                                                                              | of<br>wiw<br>us.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 31<br>33<br>15<br>53<br>53<br>15<br>54<br>8                                  | -74 0                                                                                                |
| om                                                                                                 | Roots of beginnings of months, wit fractious.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 6. 0 3 5 5 6 5 6 5 6 5 6 5 6 6 6 6 6 6 6 6 6                                 | 40<br>7<br>55<br>55                                                                                  |
| lre                                                                                                | Regir                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                                                                              |                                                                                                      |
| tw t                                                                                               | <u>e</u> =                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | <u> </u>                                                                     | <u> </u>                                                                                             |
| The                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1813<br>D.L.<br>C                                                            | 181                                                                                                  |
| 4850                                                                                               | Aumber of days<br>in each month.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8 8                                        | 29<br>29<br>30                                                                                       |
| ili yog                                                                                            | Christian date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | April<br>May<br>June<br>July<br>Aug<br>Sept<br>Oct<br>Nov                    | 10 Jan<br>8 F/b<br>10 Mar<br>10 April                                                                |
| ပီ                                                                                                 | диэтизиоО                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 00-0000000                                                                   | 01<br>01<br>01                                                                                       |
| ean.                                                                                               | tsgraom .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <del></del>                                                                  |                                                                                                      |
| s of the 3<br>(1751-£)                                                                             | Daysof the week                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | Friday<br>Tues<br>Friday<br>Friday<br>Friday<br>Sunday<br>Tues               | 41 Friday<br>42 Satur<br>43 Mon<br>45 Thurs                                                          |
| of 1<br>175                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |                                                                              | - C C C C                                                                                            |
| ths                                                                                                | of<br>gs c<br>with                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 7 30<br>7 30<br>9 31<br>9 33<br>9 33<br>1 35<br>1 36<br>1 36<br>1 36<br>1 40 | 7 41<br>3 42<br>7 43<br>8 45                                                                         |
| nou                                                                                                | Roots of<br>ginnings<br>ouths, w<br>fractions                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | v. v. 1919 1919 1919 1919 1919 1919 1919                                     | 11 17<br>51 33<br>89 57<br>0 18                                                                      |
| ve 1                                                                                               | Roots of beginnings mouths, wit fractions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 444<br>404<br>404<br>414<br>411<br>388<br>338<br>338<br>338<br>338           | 64 43 63                                                                                             |
| wel                                                                                                | B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | <u> </u>                                                                     | <u> </u>                                                                                             |
| The t                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1754<br>Dom,<br>letter<br>F                                                  | E<br>1755                                                                                            |
| 45.17                                                                                              | Kumber of days<br>in each worth.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 31<br>32<br>31<br>31<br>30                                                   | 30 30                                                                                                |
|                                                                                                    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | or it                                                                        | rii rii                                                                                              |
| a,                                                                                                 | Concurrent<br>Christian date.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Apr<br>May<br>June<br>July<br>Aug<br>Sept<br>Nov<br>Dec                      | 746<br>Jan<br>Feb<br>Mar<br>April                                                                    |
|                                                                                                    | 44,2411.203                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 0000000000                                                                   | 01<br>8<br>01<br>01                                                                                  |
| year Cali yug                                                                                      | 'squom                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | s s                                                                          |                                                                                                      |
| . 0                                                                                                | Days of the week                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | C<br>Friday<br>Mon<br>Thurs<br>Mon<br>Thurs<br>Sunday<br>Wed<br>Friday       | B<br>Mon<br>Tues<br>Thurs                                                                            |
| The twelve months of the y (A. D. 1746                                                             |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 25.<br>25.<br>25.<br>25.<br>25.<br>25.<br>25.<br>25.                         | Tye (1) 4 36 26 Mo<br>Maussi 2) 31 52 27 Fuc<br>Poongoni (4) 20 16 28 Thi<br>45-18 (6) 40 37 30 Sati |
| Us o                                                                                               | Roots of beginnings of months, with fractions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | V. P. 6 15 38 16 50 17 28 18 20 17 50 20 11 19 22 119 23 43 25 43 25         | 4 252                                                                                                |
| (And                                                                                               | Roots of sginnings onths, wi fractions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | . 20 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2                                     | 0 3 5 5 5 5 6 5 6 5 6 5 6 6 6 6 6 6 6 6 6                                                            |
| Ë                                                                                                  | B. B. B. Ina                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | (5) 25<br>(1) 20<br>(1) 20<br>(1) 21<br>(1) 21<br>(2) 49<br>(3) 19<br>(6) 43 | . CCC C                                                                                              |
| elve                                                                                               | 2 =                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | · · · ·                                                                      | <u>, 577 9</u>                                                                                       |
| tw(                                                                                                | s o                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | ram<br>ram<br>sei<br>ni<br>ni<br>si                                          | si<br>goni<br>18<br>18                                                                               |
| he                                                                                                 | Names of<br>Tamul<br>months.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1745 Chaitram Vyassei Auni Audi Ausani Paratasi Arpesi Cartiga               | 17-<br>Fe<br>nussions<br>oons<br>48-<br>48-                                                          |
| T                                                                                                  | Z                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 0>4445452                                                                    | <u>⊬ੌ≅చ్ ర్</u>                                                                                      |

Common 365 days

Leap 366 days

Common 365 d.

31

365

ဗ္ဗ ဗ္ဗ

Number of days in each month.

TABLE X, continued.

Porms of Tamul years assumed with reference to the Julian Style.

|                                     | The twe             | The twelve months of the year Cali yug 4817. (*) | the year C               | ali yug 48         | 17. (*)       | The  | The twelve months of the year Cali yug | of the year                |                  | 6.3           |
|-------------------------------------|---------------------|--------------------------------------------------|--------------------------|--------------------|---------------|------|----------------------------------------|----------------------------|------------------|---------------|
| (*) It is to be remarked, in the    |                     | Boots of                                         |                          |                    | lays<br>th.   |      | Destant                                | S<br>S<br>S<br>S<br>S<br>S | otte.            |               |
| construction of the year Cali yug   | Names of<br>  Tamul | beginnings of                                    |                          |                    | nom<br>nom    |      | beginnings of                          | W act                      | retret<br>sp ar  |               |
| 4847, concurrent with our A. D.     | months.             | fractions.                                       | Jo sý                    | onoC<br>itsi11     | aguir<br>Iosa |      | months, with fractions.                | To sy<br>mmo:<br>nom       | noo!<br>iisii    |               |
| 1745-6, that no Hindu month be-     |                     |                                                  |                          |                    | N<br>N        |      |                                        | E(I                        | CP<br>C          |               |
| gins in our June (Julian Kalendar). | 1745                | L.                                               |                          |                    |               | A.D. |                                        |                            |                  | <del></del> - |
| and that the beginning of both Care | Chaitram<br>Vyassei | (2) 25 6 15 $(1)$ 20 38 16                       | 6 15 Friday 38 16 Monday | 29 Mar<br>29 April | 31            | 801  | (C) 13                                 | Sunday                     | 21 Mar           |               |
|                                     | Auni                |                                                  |                          | 30 May             | ភ             | C .  | (5) $6$ $35$ $10$                      | Satur                      |                  |               |
| tigu and Margali fall in our No.    |                     |                                                  |                          | *                  | ő             |      |                                        |                            |                  |               |
| 3.                                  | Audi                | (1) 21 28 18                                     | Monday                   | 1 July             |               |      | 48                                     | Wed                        | 23 June          |               |
| vember, a circumstance which, if    | Aurani              | (4) 49 40 20                                     | Thursday                 | I Aug              | 5 5           |      | (6), 38 0 20                           | Satur                      | 24 July          |               |
| unattended to, might perplex a      | Paratasi<br>Arpesi  | (0) 51 50 21<br>(3) 19 12 22                     | Sunday<br>Wednes         | 1 Sept<br>2 Oct    | . E. S        |      | (2) 40 10 21<br>(5) 7 32 22            | Tuesday<br>Friday          | 24 Aug           |               |
| great deal the computer, and throw  | Cartiga             | 13                                               | Friday                   |                    | 0 0<br>0 0    |      | 1 39                                   | Sunday                     |                  |               |
| much confusion in the operation for | Margali<br>Tye      | (6) 43 43 25<br>(1) 4 36 26                      | Saturday<br>Monday       | 30 Dec             | ္က            |      | (1) 32 3 25<br>(2) 52 56 26            | Monday                     | 22 Nov<br>21 Dec |               |
|                                     | 1746                | L. E                                             |                          |                    | 66            | 803  |                                        |                            | -                |               |
| altic and more come grants          | Poongoni            | (2) 31 52 27 $(4)$ 26 16 28                      | Thursday                 | 28 Jan<br>27 Feb   | 30            | 2    | (4) 20 12 27<br>(6) 8 36 98            | Thursday                   | 20 Jan           |               |
| into the other.                     | Chaitram            | 40 37                                            |                          | 29 Mar             | 30            |      | 28 57                                  | 30 Monday                  | 21 Mar           |               |

## TABLES OF JUPITER.

Tables, for computing the rank, name, and beginning of the years of the Cycle of 60 or Vrihaspati, computed relatively to the commencement of the concurrent Solar Sydereal year, according to the precept of the Sutriah Siddhanta and Commentary.

#### TABLE XI.

Jupiter's mean heliocentric motion for Solar years uncorrected, according to the Surriah Siddhanta.

|        |        | [   |       |            |        |      | II    |      |       | 1      |        |      |     |      |
|--------|--------|-----|-------|------------|--------|------|-------|------|-------|--------|--------|------|-----|------|
| Years. | μ's    | mea | n mo  | tion.      | Years. | 4':  | s mea | n mo | tion. | Years. | 74's 1 | mean | mot | ion. |
|        | Signs  | •   | ,     | -          |        | Rev  | . S.  | •    | _,_   | 1      | Rev.   | S.   | •   | - 7  |
| 1      | 1      | 0   | 21    | 6          | 10     | 0    | 10    | 3    | 31    | 100    | 8      | 5    | 5   | 10   |
| 2      | 2      | 0   | 42    | 12         | 20     | 1    | 8     | 7    | 2     | 200    | 16     | 10   | 10  | 20   |
| 3      | 3      | 1   | 3     | 18         | 30     | 2    | 6     | 10   | 33    | 300    | 25     | 3    | 15  | 30   |
| 4      | 4      | 1   | 21    | 24         | 40     | 3    | 4     | 14   | 4     | 400    | 33     | 8    | 20  | 40   |
| 5      | 5      | 1   | 45    | <b>3</b> 0 | 50     | 4    | 2     | 17   | 35    | 500    | 42     | 1    | 25  | 50   |
| 6      | 6      | 2   | 6     | 36         | 60     | 5    | 0     | 21   | 6     | 600    | 50     | 7    | 1   | 0    |
| 7      | 7      | 2   | 27    | 42         | 70     | 5    | 10    | 24   | 37    | 700    | 59     | 0    | 6   | 10   |
| 8      | 8      | 2   | 48    | 48         | 80     | 6    | 8     | 28   | 8     | 800    | 67     | 5    | 11  | 20   |
| 9.     | 9      | 3   | 9     | <b>54</b>  | 90     | 7    | 7     | 1    | 39    | 900    | 75     | 10   | 16  | 30   |
| 10     | 1 10   | 3   | 31    | 0          | 100    | 8    | 5     | 5    | 10    | 1000   | 84,    | 3    | 21  | 40   |
|        |        |     |       |            |        |      |       |      |       | 2000   | 168    | 7    | 13  | 20   |
|        |        |     |       |            |        |      | t. 5. |      | * *   | 3000   | 252    | 11   | 5   | 0    |
| ruva A | . Cali | yug | am co | mplet      | e 4100 | - 37 | 70 11 | 17   | 20 0. | 4000   | 337    | 2    | 26  | 40   |
|        | •      |     |       | -          |        |      |       |      |       | 5000   | 421    | 6    | 18  | 20   |

#### TABLE XII.

Annual Increment, or Equation of 4's mean heliocentric Longitude, according to the Tika, at the rate of 8 Revolutions in a Maha yug, as used in present times.

|         | I       |       | 1        | H     |        |        | Ш     |       |
|---------|---------|-------|----------|-------|--------|--------|-------|-------|
| Years.  | Incre   | ment. | Years.   | Incre | ment.  | Years. | Incre | ment. |
|         |         | #4    |          | ′     | н      |        |       |       |
| 1       | 2       | 21    | 10       | 0     | 24     | 100    | ,,    | 4'    |
| 2       | 4       | 48    | 20       | 0     | 48     | 200    | ,,    | 8     |
| 3       | 7       | 12    | 30       | 1     | 12     | 300    | 1 22  | 12    |
| 4       | 9       | 36    | 40       | 1     | 36     | 400    | ,,    | 16    |
| 5       | 12      | 0     | 50       | 2     | 0      | 500    | ,,    | 20    |
| 6       | 11      | 21    | 60       | 2     | 21     | 600    | ,,    | 24    |
| 7       | 16      | 48    | 70       | 2     | 48     | 700    | ,,    | 28    |
| 8       | 19      | 12    | 80       | 3     | 12     | 800    | ٠,,   | 32    |
| 9       | 21      | 36    | 90       | 3     | 36     | 900    | ,,    | 36    |
| 10      | 24      | 0     | 100      | 4     | 0      | 1000   | , ,,  | 40    |
|         |         |       |          |       |        | 2000   | 1°    | 20    |
| Druva . | A. Cal. | compl | ete 4100 | 2 5   | 6' 0". | 3000   | 2     | 0     |
|         |         | •     |          |       | İ      | 4000   | 2     | 40    |
|         |         |       |          |       | ı      | 5000   | 3     | 20    |

## TABLE XIII.

For converting Jupiter's mean heliocentric motion corrected into mean Solar Sydereal time; the year being 3650 15d 31p Sleast.

| 1   |       |         |        |             |    |       |         |        |             |     |          |        |             |    |        |                 |
|-----|-------|---------|--------|-------------|----|-------|---------|--------|-------------|-----|----------|--------|-------------|----|--------|-----------------|
| _   |       |         | I      |             | !  |       |         | 11     |             | ! _ |          | Ш      |             | !  | ]      | V               |
| ٥   | Days. | Dandas. | Palas. | Castacalas. | ,  | Days. | Dandas. | Palas. | Castucalas. | "   | Dandas.  | Palas. | Castaculas. | #4 | Palas. | Castacalas.     |
| 1   | 12    | 2       | 4      | 9,4744      | 1  | 0     | 12      | 2      | 4,1579      | 1   | 0        | 12     | 2,0693      | 1  | 0      | 12,0344         |
| 2   | 24    | 4       | 8      | 18,9489     | 2  | 0     | 24      | 4      | 8,3159      | 2   | <b>0</b> | 24     | 4.1386      | 2  | 0      | 24,0690         |
| 3   | 36    | 6       | 12     | 28,4232     | 3  | 0     | 36      | 6      | 12,4373     |     | 0        | 36     | 6,2079      |    | 0      | 36,1034         |
| 4   | 48    | 8       | 16     | 37,8977     | 4  | 0     | 48      | 8      | 16,6316     | 4   | 0        | 48     | 8,2772      | -1 | 0      | 48,1380         |
| 5   | 60    | 10      | 20     | 47,3722     | 5  | L     | 0       | 10     | 20,7895     | 5   | 1        | 0      | 10,3465     | 5  | 1      | 0,1721          |
| 6   | 72    | 12      | 24     | 56,8466     | 6  | 1     | 12      | 12     | 24,9474     | 6   | 1        | 12     | 12,4157     | 6  | 1      | 12,2070         |
| 7   | 81    | 11      | 29     | 6,3210      | 7  | 1     | 24      | 14     | 29,1053     | 7   | 1        | 24     | 14,4850     | 7  | 1      | 24,2414         |
| 1.8 | 96    | 16      | 33     | 15,7954     | 8  | Ĺ     | 36      | 16     | 33,2633     | 8   | 1        | 36     | 16,5543     | S  | 1      | 36,2758         |
| 9   | 108   | 18      | 37     | 25,2699     | 0  | 1     | 48      | 18     | 37,4212     | 9   | 1        | 48     | 18,6236     | 9  | 1      | 48,3103         |
| 10  | 120   | 20      | 41     | 34,7443     | 10 | 2     | 0       | 20     | 41.5791     | 10  | 2        | 0      | 20,6929     | 10 | 2      | 0,3448          |
| 50  | 240   | 41      | 23     | 9,4886      |    |       | 0       | 41     | 23,1581     | 20  | 4        | 0      | 41,3859     | 20 | 4      | 0,6897          |
| 30  | 361   | 2       | 4      | 44,2329     | 30 | 6     | .1      | 2      | 4,7372      |     | 6        | 1      | 2,0789      | 30 | 6      | 1,0346          |
|     |       |         |        |             | 10 |       | 1       | 22     | 46,3163     |     |          | 1      | 22,7719     | 40 | 8      | 1,3795          |
|     |       |         |        |             |    | 10    | 1       | 43     | 27,8954     |     |          | 1      | 43,4649     |    |        | 1,7244          |
|     | l<br> |         |        |             | 60 | 12    | 2       | 4      | 9,4744      | 160 | 12       | 2      | 4,1379      | 60 | 12     | 2,06 <b>9</b> 2 |

## TABLE XIV.

For converting the fraction of the first term of the Jyautistava Rule into Saura time, the Solar year being of 360 days, \(\frac{18}{1875}\) expressing such a Saura year.

| 1          |       | I       |        | 11         | II    |         |            |            | 111   |            |
|------------|-------|---------|--------|------------|-------|---------|------------|------------|-------|------------|
| Numerators | Days. | Dandas. | Palas. | Numerators | Days. | Dandas. | Palas.     | Numerators | Days. | Dandas.    |
| 1          | 0     | 11      | 31,2   | 10         | 1     |         | 12         | 100        | 19    | 12         |
| 2<br>3     | 0     | 23      | 2, 1   | 20         | 3     | 50      | 2.1        | 200        | 38    | 24         |
|            | 0     | 34      | 33.6   | 30         | 5     | 45      | <b>3</b> 6 | 300        | 57    | 36         |
| 4          | 0     | 46      | 4,8    | 40         | 7     | 40      | 48         | 400        | 76    | 48         |
| 5          | 0     | 57      | 36,0   | 50         | 9     | 36      | 0          | 500        | 96    | 0          |
| 6          | 1     | 9       | 7,2    | 6.0        | 11    | 31      | 12         | 600        | 115   | 12         |
| 7          | 1     | 20      | 38,4   | 70         | 13    | 26      | 24         | 700        | 134   | 24         |
| 8          | 1     | 32      | 9,6    | 80         | 15    | 21      | 36         | 800        | 153   | <b>3</b> 6 |
| 9          | 1     | 43      | 40,8   | 90         | 17    | 16      | 48         | 900        | 172   | 48         |
| 10         | 1     | 55      | 12,0   | 100        | 19    | 12      | 0          | 1000       | 192   | o          |

## EXAMPLE TABLE XIV.

Let it be required to convert the fraction  $\frac{1854}{1875}$  into Saura time.

| By Table XIV, . 1 | 1000 | _ | 192ª | Og | O٠  |
|-------------------|------|---|------|----|-----|
| •                 | 800  | - | 153  | 36 | 0   |
|                   | 50   | - | 9    | 36 | 0   |
|                   | 4    | - |      | 46 | 4,8 |
| Saura time sought |      | - | 355  | 58 | 4,8 |

#### TABLE XV.

I:

II.

Degrees of O's motion reduced to Saura time.

Saura time reduced to degrees, &c. of O's motion.

| Degrees. | Days.          | A III  | Days,<br>Danda<br>Casta | 15,      |               | Months of 30 days. | •        | ı          | Days,<br>Dandas<br>Casta. | #<br>#   | #<br>#<br>#!! |
|----------|----------------|--------|-------------------------|----------|---------------|--------------------|----------|------------|---------------------------|----------|---------------|
| 1        | 12             | 1      | 0                       | 12       |               | 1                  | 2        | 30<br>0    | 1                         | 0        | 5             |
| 2<br>3   | 24<br>36       | 2<br>3 | 0                       | 24<br>36 |               | 2 3                | 5<br>7   | 30         | 2 3                       | 0        | 10<br>15      |
|          |                | _      |                         |          |               |                    | <u> </u> |            |                           | <u> </u> |               |
| 4        | 48             | 4      | 0                       | 48       |               | 4                  | 10       | 0          | 4                         | 0        | 20            |
| 5<br>6   | 60             | 5      | 1                       | 0        |               | 5                  | 12       | 30         | 5                         | 0        | 25            |
| 6        | 72             | 6      | 1                       | 12       |               | 6                  | 15       | 0          | 6                         | 0        | 30            |
| 7        | - <del>-</del> | 7      | 1                       | 24       |               | 7                  | 17       | <b>3</b> 0 | 7                         | 0        | 35            |
| 8        | 96             | 8      |                         | 36       | 11 '          | 8                  | 20       | 0          | 8                         | 0        | 40            |
| 9        | 108            | 9      | 1                       | 48       | ll .          | 9                  | 22       | 30         | 9                         | 0        | 45            |
| 10       | 120            | 10     | 2                       | 0        | -             | 10                 | 25       | 0          | 10                        | 0        | 50            |
| 20       | 240            |        | 4                       | 0        | 1             | 11                 | 27       | 30         | 20                        | ľ        | 40            |
| 30       | 360            |        | 6                       | 0        |               | 12                 | 30       | 0          | 30                        | 2        | <b>3</b> 0    |
| 1-       | _              | 40     | 8                       | 0        | $\parallel -$ |                    | -        |            | 40                        | 3        | 20            |
|          | 1              | 50     |                         | 0        | 11            |                    | 1        |            | 50                        | 4        | 10            |
| 1        | i              | 60     |                         | 0        | 11            | Į†                 | l        |            | 60                        | 1 5      | 0             |

## EXAMPLE TABLE XIII.

Let it be required to convert 16' 44" 24" of Jupiter's motion, into Solar Sydereal time.

|                            |   |   | D. | G. | v. | P.      |
|----------------------------|---|---|----|----|----|---------|
| 10′                        | - | _ | 2  | 0  | 20 | 41,5791 |
| 6                          | _ | _ | 1  | 12 | 12 | 24,9474 |
| 40"                        |   | - |    | 8  | 3  | 22,7719 |
| 4                          |   | _ |    |    | 48 | 8,2772  |
| 20"                        | _ |   |    |    | 4  | 0,6897  |
| 4                          | - | - |    |    |    | 48,1380 |
| Solar Sydereal time sought | - | • | 3  | 21 | 27 | 26,4033 |

## EXAMPLE TABLE XV.

## I. Degrees into Time.

II. Time into Degrees.

the Sun's motion into Saura time, of 1 day to 1°. days or 330d, od 13s 12v into degrees.

|      |   | D.  | G. | ▼. |
|------|---|-----|----|----|
| 20°  | _ | 240 | 0  | 0  |
| 7    | - | 81  | 0  | 0  |
| 3:)' | - | 6   | 0  | 0  |
| 1    | - |     | 12 | 0  |
| 6"   | _ |     | 1  | 12 |
|      |   |     |    |    |

Time sought - 330 13 12 or 11 months of 30 days Od 13g 12v.

Let it be required to convert 27° 31' 6" of Let it be required to convert 11 months (of 30

|                       | •  | •  | #  | W  |
|-----------------------|----|----|----|----|
| 11 months -           | 27 | 30 | 0  | 0  |
| O days -              | 0  | 0  | 0  | 0  |
| 10 gud                | 0  | 0  | 50 | 0  |
| 3                     | 0  | 0  | 15 | 0  |
| 10 vig                | 0  | 0  | 0  | 50 |
| 2                     | 0  | 0  | 0  | 10 |
| Degrees, &c. sought - | 27 | 31 | σ  | 0  |

TABLE XVI.

For converting Saura time of one day to a degree, to mean Solar Sydereal time, the year being 365d 15z 31v 15p.

|                |       | I         |          |                 | I        | [                | ]               | III      |
|----------------|-------|-----------|----------|-----------------|----------|------------------|-----------------|----------|
| Saura<br>Days. | Days. | Guddias.  | Vigud.   | Saura<br>Dandas | Guddias. | Vigud.           | Saura<br>Palas. | Vigud.   |
| 1              | 1     | 0         | 52,58681 | 1               | 1        | 0,87611          | 1               | 1,01460  |
| 2              | 2     | 1         | 45,17361 | 2 3             | 2        | 1,75289          | 2               | 2,02921  |
| 2<br>3         | 3     | 2         | 37,76042 | 3               | 3        | 2,62934          | 2<br>3          | 3,04381  |
| 4              | 4     | 3         | 30,34722 | 4               | 4        | 3,50578          | 4               | 4,05812  |
| 5              | 5     | 4         | 22,93403 | 5               | 5        | 4,38223          | 5               | 5,07303  |
| 6              | 6     | 5         | 15,52083 | 6               | 6        | 5,25868          | 6               | 6,08763  |
| 7              | 7     | 6         | 8,10764  | 7               | 7        | 6,13513          | 7               | 7,10224  |
| 8              | 8     | 7         | 0,69444  | 8               | 8        | 7,01157          | 8               | 8,11684  |
| 9              | 9     | 7         | 53,28124 | 9               | 9        | 7,88802          | 9               | 9,13145  |
| 10             | 10    | 8         | 45,86805 | 10              | 10       | 8,76447          | 10              | 10,14607 |
| 20             | 20    | 17        | 31,73610 | 20              | 20       | 17,52894         | 20              | 20,29215 |
| 30             | 30    | 26        | 17,60415 | 30              | 30       | 26,29340         | 30              | 30,43822 |
| 40             | 40    | 35        | 3,47220  | 40              | 40       | 35,05787         | 40              | 40,58429 |
| 50             | 50    | 43        | 49,34025 | 50              | 50       | 43,82234         | 50              | 50,73037 |
| 60             | 60    | <b>52</b> | 35,20835 | 60              | 60       | <b>6</b> 2,58681 | 60              | 60,87644 |
| 70             | 71    | 1         | 21,07640 |                 |          | •                |                 |          |
| 80             | 81    | 10        | 6,94445  |                 | ]        |                  | 1               |          |
| 90             | 91    | 18        | 52,81250 |                 | Ì        |                  | Ì               | į        |
| 100            | 101   | 27        | 38,68055 |                 |          |                  |                 |          |
| 200            | 202   | 55        | 17,36110 |                 | 1        |                  |                 | 1 1      |
| 300            | 304   | 22        | 56,04165 |                 | 1        |                  |                 |          |

## EXAMPLE TABLE XVI.

Let it be proposed to convert 355d 49 dandas, 29,95 palas, expressed in Saura time, into Solar Sydereal time, the year being 365d 15g 31v 15p.

|                              | Saura. |              |      |     | Sydereal. |          |          |  |  |
|------------------------------|--------|--------------|------|-----|-----------|----------|----------|--|--|
|                              |        |              |      |     | D,        | GUD.     | VIGUD.   |  |  |
| Column I                     | •      | 3004         | -    | -   | 304       | 22       | 56,04165 |  |  |
|                              |        | 50           | -    | -   | 50        | 43       | 49,34025 |  |  |
|                              |        | 5            | _    | -   | 5         | 4        | 22,93403 |  |  |
| II                           | •      | <b>4</b> 0da | D.   | -   |           | 40       | 35,05787 |  |  |
|                              |        | 9            | _    | -   |           | δ        | 7,88802  |  |  |
|                              |        | <b>2</b> 0pa | las, | -   |           |          | 20,29215 |  |  |
| III                          |        | 9            | -    | -   |           |          | 9,13145  |  |  |
|                              |        | 0,9          | _    | -   |           |          | 0,91345  |  |  |
|                              |        | 0,0          | 5    | -   |           |          | 0,05073  |  |  |
| Total in Solar Sydereal time |        |              | •    | 361 | 1         | 21,64960 |          |  |  |

#### TABLE XVII.

Exhibiting the progress of Jupiter in degrees, &c. for Solar years of 3650 15d 31p 31c corresponding to Vrihaspa'i years of 3610 2d 4p 44c,2329 as deduced from the precepts of the Surriah Sidlhanta and Tika.

|                 | I.   |                   |    |            |    |    | II.                                                                                                                       |  |  |  |  |  |  |
|-----------------|------|-------------------|----|------------|----|----|---------------------------------------------------------------------------------------------------------------------------|--|--|--|--|--|--|
| Solar<br>Years. |      | piter's<br>Levolu |    |            |    |    | Corresponding duration of U's time its year being 3610 2d 40 44c,2329 Solar time, the rest being expressed in Solar time. |  |  |  |  |  |  |
|                 | Rev. | Signs             | •  | ,          | "  | Л  | Yrs. Days. Dan. Pal. Cast.                                                                                                |  |  |  |  |  |  |
| 1               | 0    | 1                 | 0  | 21         | 3  | 30 | 1 4 13 26 46,7055                                                                                                         |  |  |  |  |  |  |
| 2               | 0    | 2                 | 0  | 42         | 7  | 12 | 2 8 26 53 33,5310                                                                                                         |  |  |  |  |  |  |
| 3               | 0    | 3                 | 1  | 3          | 10 | 48 | 3 12 40 20 20,2965                                                                                                        |  |  |  |  |  |  |
| 4               | 0    | 4                 | 1  | 24         | 14 | 24 | 4 16 53 47 7,0620                                                                                                         |  |  |  |  |  |  |
| 5               | 0    | 5                 | 1  | 45         | 18 | 0  | 5 21 7 13 53,8274                                                                                                         |  |  |  |  |  |  |
| 6               | 0    | 6                 | 2  | 6          | 21 | 36 | 6 25 20 40 40,5929                                                                                                        |  |  |  |  |  |  |
| 7               | 0    | 7                 | 2  | 27         | 25 | 12 | 7 29 34 7 27,3581                                                                                                         |  |  |  |  |  |  |
| 8               | 0    | 8                 | 2  | 48         | 28 | 48 | 8 33 47 34 14,1239                                                                                                        |  |  |  |  |  |  |
| 9               | 0    | 9                 | 3  | 9          | 32 | 24 | 9 38 1 1 0,8894                                                                                                           |  |  |  |  |  |  |
| •10             | 0    | 10                | 3  | <b>3</b> 0 | 33 | 0  | 10 42 14 27 47,6552                                                                                                       |  |  |  |  |  |  |
| 20              | 1    | 8                 | 7  | 1          | 12 | 0  | 20 87 28 55 35,3:01                                                                                                       |  |  |  |  |  |  |
| 30              | 2    | 6                 | 10 | 31         | 48 | 0  | 30 126 43 23 23,9656                                                                                                      |  |  |  |  |  |  |
| 40              | 3    | 4                 | 14 | 2          | 24 | 0  | 40 168 57 51 10,6208                                                                                                      |  |  |  |  |  |  |
| 50              | 4    | 2                 | 17 | 33         | 0  | 0  | 50 211 12 18 58,2760                                                                                                      |  |  |  |  |  |  |
| 60              | 5    | 0                 | 21 | 3          | 36 | 0  | 60 253 26 46 45,9312                                                                                                      |  |  |  |  |  |  |
| 70              | 5    | 10                | 21 | 34         | 12 | υ  | 70 295 41 14 33,5864                                                                                                      |  |  |  |  |  |  |
| 80              | 6    | 8                 | 28 | 4          | 48 | 0  | 80 337 55 43 21,2416                                                                                                      |  |  |  |  |  |  |
| 90              | 7    | 7                 | 1  | 35         | 24 | 0  | 91 19 8 5 24,6639                                                                                                         |  |  |  |  |  |  |
| 100             | 8    | 5                 | 5  | 6          | 0  | 0  | 101 61 22 33 12,8196                                                                                                      |  |  |  |  |  |  |

## EXAMPLE TIBLE XVII.

1º Wanted the number of Jupiter's mean heliocentric revolutions and parts in 175 Solar years.

|                   |            |   |   | Answer | 14 | 9  | 1  | 25 | 30 |
|-------------------|------------|---|---|--------|----|----|----|----|----|
| 5                 | do.        | • | • | •      | 0  | 5  | 1  | 45 | 18 |
|                   | do.        | - | • | -      | 5  | 10 | 24 | 34 | 12 |
| Part I, for 100 S | olar years | } | • | -      | 8  | 5  | 5  | 6  | 0  |
|                   |            |   |   |        | R. | S. | -  | •  | "  |

29 Wanted the time in terms of Jupiter's own year, answering to 175 Solar years.

|                    |         |           |             | Y.  |     |    |            | e.      |  |
|--------------------|---------|-----------|-------------|-----|-----|----|------------|---------|--|
| Part II, for 100 9 | Solar y | ears      | •           | 101 | 61  | 22 | 3 <b>3</b> | 12,3196 |  |
| 70                 | do.     | •         | •           | 70  | 295 | 41 | 14         | 33.5564 |  |
| 5                  | do.     | <b>~</b>  | •           | 5   | 21  | 7  | 13         | 53,8274 |  |
| As the days excee  | d 1 of  | 4's years | -           | 176 | 378 | 11 | 1          | 39,7331 |  |
| <del>-</del>       |         | Subt      | ract 1 year | r   | 361 | 2  | 4          | 44,2329 |  |

TABLE XVIII.

Exhibiting the Epochs of expunged years of the Cycle of 60 years, from the beginning of the Cycle yug to A. 5128, in mean Solar Sydereal time.

|                                     |            | 14's me  | anl                        |                    |            |            |          | 1                         | 12          |
|-------------------------------------|------------|----------|----------------------------|--------------------|------------|------------|----------|---------------------------|-------------|
| Epochs in Christi<br>an years A. C. |            | helioce  |                            |                    |            |            |          |                           | n           |
| A C                                 |            | tric Lo  | n.                         |                    |            |            |          | 128                       | tı          |
| ars                                 | gpo        | gitude.  | - 1                        | ທໍ                 |            | <u>a</u>   | ٠        | g .                       | ų           |
| yea                                 | Periods    |          | {                          | ears.              | Days.      | Danda      | Palas.   | Castacalas                | Į           |
| E a                                 | ية ا       | R.       | S.                         | <b>≯</b>           | Α          | Ä          | <u> </u> | Ö                         | _           |
| 3046                                | 1          | 4        | 8                          | 55                 | 128        | 42         | 31       | 52,0636                   |             |
| 2950                                | 2          | 11       | 11                         | 141                | 126        | 28         | 13       | 34,4625                   |             |
| 2874                                | 3          | 19       | 2                          | 227                | 124        | 13         | 55       | 16,8614                   | Ü           |
| 2788<br>2702                        | <b>4</b> 5 | 26<br>33 | 5<br>8                     | 31 <b>3</b><br>399 | 121        | 59         | 36<br>18 | 59,2603                   |             |
| I                                   |            | I—       |                            |                    | 119        | 45         |          | 41,6592                   |             |
| 2616                                | 6          | 40       | 11                         | 48 <b>5</b><br>571 | 117        | 31         | 0<br>42  | 24,0581                   |             |
| 2530<br>2444                        | 8          | 48<br>55 | 5                          | 657                | 115<br>113 | 16<br>2    | 23       | 6,4570<br>48,8559         | il          |
| 2358                                | 9          | 62       | 8                          | 743                | 110        | 48         | ~5       | 31,2548                   | Ш           |
| 2272                                | 10         | 69       | 11                         | 829                | 103        | 33         | 47       | 13,6537                   |             |
| 2186                                | 11         | 77       | 2                          | 915                | 106        | 19         | 28       | 56,0526                   | H           |
| 2100                                | 12         | 84       | 5                          | 1001               | 104        | 5          | 10       | 38,4515                   | -           |
| 2014                                |            | 91       | 8                          | 1087               | 101        | 50         | 52       | 20,8504                   |             |
| 1928                                |            | 98       | 11                         | 1173               | 99         | 36         | 34       | 3,2493                    |             |
| 1842                                | 15         | 106      | - 2                        | 1259               | 97         | 22         | 15<br>   | 45,6482                   |             |
| 1756                                | 16         | 113      | 5                          | 4                  | 95         | 7<br>53    | 57<br>39 | 28,0471<br>10.4460        |             |
| 1670<br>1534                        |            | 120      | - <b>8</b><br>- <b>1</b> 1 | 1517               | 92<br>90   | 39         | 20       | ,                         | 11          |
| 1498                                | ,          | 135      | 2                          | 1603               | 88         | 2 <b>5</b> | 20       | 52,8449<br>35,2438        | $\parallel$ |
| 1412                                |            | 142      | 5                          | i .                | 86         | 10         | 44       | 17,6427                   | li          |
| 1326                                | !          | 149      | 8                          | 1775               | 83         | 56         | 26       | 0,0416                    |             |
| 1240                                |            | 156      |                            | 1861               | 81         | 42         | 7        | 42,4405                   | 11          |
| 1154                                |            | 164      | 2                          | 1947               | 79         | 27         | 49       | 24,8394                   | 11          |
| 1068                                |            | 171      | 5                          |                    | 77         | 13         | 31       | <b>7,23</b> 8 <b>3</b>    | П           |
| 982                                 | 25         | 178      | 8                          | 2119               | 74         | 59         | 12       | 49,6372                   |             |
| 896                                 |            | 185      | 11                         | 2205               | 72         | 44         | 54       | 32,0361                   |             |
| 810                                 |            | 193      | 2                          | 2291               | 70         | 30         | 36       | 14,4350                   | 11          |
| 724<br>638                          |            | 200      | 5<br>8                     | 1 -                | 68<br>66   | 16<br>1    | 17<br>59 | <b>5</b> 6,8339           | Н           |
| 559                                 |            | 214      | 11                         | 3 .                | 63         | 47         | 41       | 39,2328<br>21,6317        |             |
| 466                                 | 31         | 222      |                            | 2635               | 61         | 33         | 23       | 4,0306                    | •           |
| 380                                 |            | 229      |                            | 2721               | 59         | 19         | 4        | 46,4295                   | Ш           |
| 294                                 | ,          | 236      | 8                          | 2807               | 57         | 4          | 46       | 23,8284                   | li          |
| 208                                 | 1 :        |          | 11                         |                    | 54         | 50         | 28       | 11,2273                   |             |
| 129                                 | -1         | -        |                            | -                  | 52         | 36         | 9        | 53,6262                   |             |
| 30<br>A D                           |            | 253      | ;                          | 3065               | 50         | 21         | 51       | 36,0251                   |             |
| A.D                                 |            | 265      | 9                          | 3151               | 40         | ~          | 0.4      | 10 4040                   | 1.          |
| 13                                  |            |          |                            | 1 3237             | 48<br>45   | 7<br>53    | 33<br>15 | 18,4240                   |             |
| 22                                  | 2 39       |          | 9                          | 2 332 <b>3</b>     | 43         | 33<br>33   | 56       | 0,8229<br><b>43</b> ,2218 |             |
| 30                                  |            |          |                            | 5 340 <b>9</b>     | 41         | 24         | 38       | 25,6207                   |             |
| 39                                  |            | 1        |                            | 8 7495             |            | 10         | 20       | 8,0196                    | - 1         |
| 48                                  |            |          |                            | 1 3581             | 36         | 56         | 1        | 50,4185                   |             |
| 56                                  | 1          | . 1 -    |                            | 2 3667             |            |            | 43       | 32,8174                   |             |
| 65                                  | 2 44       | 316      |                            | 513753             | 32         | 27         | 25       | 15,2163                   |             |

| 4's mean neliocen-<br>tric Lon-<br>gitude. |    | nelio <b>cen-</b><br>tric <b>Lon-</b> |            | Years. | Days. | Dandas. | Palas. | Castacalas. | Periods. | Epochs in Christian years A. D. |
|--------------------------------------------|----|---------------------------------------|------------|--------|-------|---------|--------|-------------|----------|---------------------------------|
| R.                                         | s. | Ϋ́є                                   | Ä          | ۵      | Ра    | చ్      | Pe     | E i         |          |                                 |
| 323                                        | 8  | 3839                                  | 30         | 13     | 6     | 57,6152 | 45     | 738         |          |                                 |
| 330                                        | 11 | 3925                                  | 27         | 58     | 48    | 40,0141 | 46     | 824         |          |                                 |
| 333                                        | 2  | 4011                                  | 25         | 44     | 30    | 22,4130 | 47     | 910         |          |                                 |
| 345                                        | 5  | 4097                                  | 23         | 30     | 12    | 4,8119  | 48     | 996         |          |                                 |
| 352                                        | 8  | 4183                                  | 21         | 15     | 53    | 47,2108 | 49     | 1082        |          |                                 |
| 359                                        | 11 | 4269                                  | 19         | 1      | 35    | 29,6097 | 50     | 1168        |          |                                 |
| 367                                        | 2  | 4355                                  | 16         | 47     | 17    | 12,0086 | 51     | 1254        |          |                                 |
| 374                                        | 5  | 1441                                  | 14         | 32     | 58    | 54,4075 | 52     | 1340        |          |                                 |
| 381                                        | 8  | 4527                                  | 12         | 18     | 40    | 36,8064 | 53     | 1426        |          |                                 |
| 388                                        | 11 | 4613                                  | 10         | 4      | 22    | 19,2053 | 54     | 1512        |          |                                 |
| 396                                        | 2  | 4699                                  | 7          | 50     | 4     | 1,6042  | 55     | 1598        |          |                                 |
| 403                                        | 5  | 4785                                  | 5          | 35     | 45    | 44,0031 | 56     | 1684        |          |                                 |
| 410                                        | 8  | 4871                                  | 3          | 21     | 27    | 26,4020 | 57     | 1770        |          |                                 |
| 417                                        | 11 | 4957                                  | 1          | 7      | 9     | 8,8009  | 58     | 1856        |          |                                 |
| 425                                        | 9  | 5042                                  | <b>364</b> | 8      | 22    | 22,1998 | 59     | 1941        |          |                                 |
| 432                                        | 5  | 5128                                  | 361        | 54     | 4     | 4,5987  | 60     | 2027        |          |                                 |

#### EXAMPLE I.

Wanted the year of the Chacra which concurs with A. Cali yugam 55 complete, or 56 current.

I.

For 4's mean heliocentric Longitude.

|    | R.  | 5.                       | •                                     | •                                               | 4                                                                                |
|----|-----|--------------------------|---------------------------------------|-------------------------------------------------|----------------------------------------------------------------------------------|
| -  | 4   | 2                        | 17                                    | 35                                              | 0                                                                                |
| -  |     | 5                        | 1                                     | 45                                              | 30                                                                               |
|    | 4   | 7                        | 19                                    | 20                                              | 30                                                                               |
|    |     |                          |                                       | 2                                               | 12                                                                               |
|    |     |                          |                                       |                                                 |                                                                                  |
| _  | 4   | 7                        | 19                                    | 18                                              | 18                                                                               |
| +  | 4   | 7                        | 30                                    | to c                                            | omplete the                                                                      |
| Wa | nti | ng                       | 10                                    | 41                                              | 42                                                                               |
|    |     | - 4<br>- 4<br>- 4<br>+ 4 | - 4 2<br>- 5<br>4 7<br>- 4 7<br>+ 4 7 | 4 2 17<br>5 1<br>4 7 19<br>- 4 7 19<br>+ 4 7 30 | R. 5. 7 4 2 17 35 5 1 45 4 7 19 20 - 2 - 4 7 19 18 + 4 7 30 to co  Wanting 10 41 |

To convert which into time.

|                |      | D.  |     |     |         |
|----------------|------|-----|-----|-----|---------|
| Table XIII, 10 | - 1  | 120 | 20  | 41  | 34,7413 |
| 40             | -    | 8   | 1   | 22  | 46,3163 |
| 1              | •    |     | 12  | 2   | 4,1579  |
| 40             | -    |     | 8   | 1   | 22,7719 |
| 2              | -    |     |     | 24  | 4,1386  |
| 10° 41′ 42″    | = 1  | 128 | 42  | 31  | 52,1296 |
| Ву Т           | ľabl | e X | VI  | I   | 52,0636 |
| Difference     | of   | the | Tat | les | 0,0660  |

Lastly, 
$$\frac{4r \times 12 + 8s}{60} = 56$$
 years (4's.)

The first expunded year of the Chacra after the Epoch Califugam is, therefore, due when 559 1280 424 31p 52c Solar time, have expired, and 42s Longitude is precisely (4r) 8s.

#### EXAMPLE II.

For the nearest expunged year of the Chacra to A. Cali yugam 5129.

|         |       |       |     |    |            | Y.   |   | R.  | s. | •  | •  | *           |    |
|---------|-------|-------|-----|----|------------|------|---|-----|----|----|----|-------------|----|
| Fo      | r the | e Bij | ah. |    | Table XI,  | 5000 | - | 421 | 6  | 18 | 20 | 0           |    |
| Table Y |       | 3     |     |    | "          | 100  | - | 8   | 5  | 5  | 10 | 0           |    |
| 5000    | 3     | 20'   |     |    | ,,         | 20   | - | 1   | 8  | 7  | 2  | 0           |    |
| 100     |       | 4     |     |    | <b>)</b> ; | 9    | - |     | 9  | 3  | 9  | 54          |    |
| 20      |       | 0     | 48  |    | ••         |      |   |     |    |    |    | <del></del> |    |
| 9       |       |       | 21  | 36 |            | 5129 | - | 432 | 5  | 3  | 41 | 54          |    |
|         |       |       |     |    |            |      |   |     |    | 3  | 25 | 9           | 36 |
|         | 3     | 25    | 9   | 36 |            |      |   |     |    |    |    |             |    |
|         |       |       |     |    |            |      |   | 432 | 5  | 0  | 16 | 44          | 24 |

which shows that on the last day of the Solar year 5129 the Epoch has passed by 16' 44" 24" of 24's motion, which converted into Solar time by Table XIII, give

Epoch of Cshaya when 21's Longitude is precisely (432r) 5s... A. Cali yugam

For 4's years 432r×12+55 = 5189 years. Hence 5189 - 5129 = 60, which shews that in 5129 Solar Sydereal years, there is a whole cycle or 60 4's years expunged according to Astronomical computation.

Example III.

To find the cycles and years of Jupiter, the natural days, guddias, viguddias, &c. elapsed of that account on the birth of Christ.

The year sought will be the 44th called Sadharana. For the time due to the degrees above complete signs.

By Table XIII the degrees, &c. being 8° 27' 3' 36".

|             |   | D. | G. | v. | P.      |
|-------------|---|----|----|----|---------|
| 8°          | - | 96 | 16 | 33 | 15,7954 |
| <b>2</b> 0′ | - | 4  | 0  | 41 | 23,1531 |
| 7           | - | 1  | 24 | 14 | 29,1053 |
| 3"          | - |    |    | 36 | 6,2079  |
| $30^{n}$    | - |    |    | 6  | 1,0346  |
| 6           | - |    |    | 1  | 12,2070 |
|             |   |    |    |    |         |

The whole time expired is therefore 3137 years of Jupiter + 101 42 12 27,5083

But it is not necessary to refer to the birth of Christ to find the Vrihaspati year corresponding to any proposed year since that Epoch, and when the name and rank of the Chacra year only are wanted, the Rule is confined to a common addition and division.

#### RULE.

- "If the Christian year be proposed, find the corresponding one of the Callyug by adding 3101 thereto, the sum will be the last expired year of the same."
- "Divide the expired years of the Cali yag by 56; add the quotient to the dividend; divide again the sum by 60, the quotient will give the number of cycles expired; and to the remainder, if the proposed year should fall less than 31 from the last expunged year of the Chacra (found in Table XVIII) add 28; but if it falls in the 55 remaining years of a cycle of 86 years, add 27 years, and the remainder so increased, will indicate the numeral of the current year of the Chacra, and consequently its appropriate name."

#### EXAMPLE I.

Let the rank and name of the Chacra year which corresponds with A. D. 1322, be required,

| 4923                              | + 3101                   |
|-----------------------------------|--------------------------|
| By Table XVIII the last expunged  | 86)4923(5 <b>7</b><br>57 |
| year fell on A. C.<br>4871 - 4871 | 60) 1930(83<br>180       |
| Difference 52                     | 0                        |
| therefore 27 are to be added.     | + 27                     |

which increased remainder, indicates at once Vijaya, the 27th year of the Chacra, as the current one.

#### EXAMPLE II.

Let the same be wanted for A. D. 1951. 1951 5052 **→** 3101 By Table XVIII 86)5052(58 the last expunged 58 year fell on A. C. 60)5110(85 5042 310 Difference 10 10 which difference (being less than 31) indicates that 28 + 28 are to be added to the remainder after division by 60. 38

The increased remainder indicates at once Cradhi, the 38th year of the Cycle, as the current one.

TABLE XIX.

Exhibiting the Epochs of the expunged years of the Cycle of 60 years, agreeably to the Jyantistava, compared with those of the Surriah Siddhanta from the birth of Salivahana.

| Periods from   | als.           | Years of             | the (        | Cali yug.            | 1    | Y ear                         |                         | the<br>ahan:         | birth of                              | rals.                   | Periods from<br>the birth of<br>Salivahana. | Epochs in<br>Christian<br>years ac-<br>cording to |
|----------------|----------------|----------------------|--------------|----------------------|------|-------------------------------|-------------------------|----------------------|---------------------------------------|-------------------------|---------------------------------------------|---------------------------------------------------|
| Perio<br>the C | Intervals.     | Surriah<br>Siddhanta | Diff.        | Jyautis-<br>tava.    | Epoc | hs a                          | ccord<br>tist           |                      | the Jyau-                             | Intervals.              | Perio<br>the b                              | the Jyau-<br>tistava.                             |
| 38<br>39<br>40 | ¥.<br>86<br>86 | 3237<br>3323<br>3409 | +2<br>1<br>1 | 3239<br>3324<br>3410 | 1    | <b>y.</b><br>60<br>145<br>231 | D.<br>363<br>364<br>361 | n.<br>42<br>40<br>21 | P.<br>0.87662<br>27,35993<br>45,31653 | ¥.<br>85<br>86≭         | 1<br>2<br>3                                 | 158<br>223<br>309                                 |
| 41             | 86             | 3195                 | 0            | 3495                 | 4    | 816                           | 362                     | 20                   | 11,80004                              | 85                      | 4                                           | 394                                               |
| 42             | 86             | 3581                 | -1           | 3580                 |      | 101                           | 363                     | 18                   | 38,28336                              | 85                      | 5                                           | 479                                               |
| 43             | 86             | 3667                 | 2            | 3665                 |      | 186                           | 364                     | 17                   | 4,76668                               | 85                      | 6                                           | 564                                               |
| 44<br>45<br>46 | 86<br>86       | 3753<br>3839<br>3925 | 3<br>3<br>4  | 3750<br>3836<br>3921 | 6    | 571<br>557<br>742             | 0<br>361<br>362         | 0<br>56<br>55        | 0,0<br>49,20659<br>15,68991           | 85<br>86 <b>≭</b><br>85 | 7<br>8<br>9                                 | 649<br>735<br>820                                 |
| 47             | 86             | 4011                 | 5            | 4006                 | 9    | 927                           | 363                     | 53                   | 42,17323                              | 85                      | 10                                          | 905                                               |
| 48             | 86             | 4097                 | 6            | 4091                 |      | 912                           | 364                     | 52                   | 8,65659                               | 85                      | 11                                          | 990                                               |
| 49             | 86             | 4183                 | 6            | 4177                 |      | 998                           | 361                     | 33                   | 26,61318                              | 86 <b>≭</b>             | 12                                          | 1076                                              |
| 50             | 86             | 4269                 | 7            | 4262                 | 11   | 083                           | 362                     | 31                   | 83,09650                              | 85                      | 13                                          | 1161                                              |
| 51             | 86             | 4355                 | 8            | 4347                 |      | 68                            | 363                     | 30                   | 19,57982                              | 85                      | 14                                          | 1246                                              |
| 52             | 86             | 4441                 | 9            | 4432                 |      | 253                           | 364                     | 28                   | 46,03614                              | 85                      | 15                                          | 1331                                              |
| 53             | 86             | 4527                 | 9            | 4518                 |      | 39                            | 361                     | 10                   | 4,02006                               | 86 <b>≭</b>             | 16                                          | 1417                                              |
| 54             | 86             | 4613                 | 10           | 4603                 |      | 24                            | 362                     | 8                    | 30,50338                              | 85                      | 17                                          | 1502                                              |
| 55             | 86             | 4699                 | 11           | 4688                 |      | 09                            | 363                     | 6                    | 56,98670                              | 85                      | 18                                          | 1587                                              |
| 56             | 86             | 4785                 | 12           | 4773                 |      | 094                           | 364                     | 5                    | 23,47002                              | 85                      | 19                                          | 1672                                              |
| 57             | 86             | 4871                 | 13           | 4858                 |      | 079                           | 365                     | 3                    | 49,95325                              | 85                      | 20                                          | 1757                                              |
| 58             | 86             | 4957                 | 13           | 4944                 |      | 765                           | 361                     | 45                   | 7,90993                               | 86*                     | 21                                          | 184 <b>3</b>                                      |
| 59             | <b>★</b> 85    | 5042                 | 13           | 5029                 |      | 350                           | 36 <b>2</b>             | 43                   | 34,39327                              | 85                      | 22                                          | 1928                                              |
| 60             | 86             | 5128                 | 14           | 5104                 |      | 35                            | 363                     | 42                   | 0,87657                               | 85                      | 23                                          | 203 <b>3</b>                                      |

( 24 )

TABLE XX.

Of the Sun's mean motion for days.

| Days. | Sur | i's m | ean n | notio | n.  | Days.          | Su         | n's ma | ean r | notio | n,        |
|-------|-----|-------|-------|-------|-----|----------------|------------|--------|-------|-------|-----------|
|       | s.  | •     | ,     | "     | *   |                | <b>s</b> . | •      | ,     | Ħ     |           |
| 1     | 0   | 0     | 59    | 8     | 10  | 1000           | 8          | 25     | 36    | 9     | 33        |
|       | 0   | 1     | 58    | 16    | 20  | 2000           | 5          | 21     | 12    | 19    | 7         |
| 2 3   | 0   | 2     | 57    | 24    | 3 L | 3000           | 2          | 16     | 48    | 28    | 40        |
| 4     | 0   | 3     | 56    | 32    | 41  | 4000           | 11         | 12     | 24    | 38    | 14        |
| 5     | 0   | 4     | 55    | 40    | 51  | 5000           | 8          | 8      | 0     | 47    | 47        |
| 6     | 0   | 5     | 54    | 49    | 1   | 6000           | 5          | 3      | 36    | 57    | 20        |
| 7     | 0   | 6     | 53    | 57    | 11  | 7000           | 1          | 29     | 13    | 6     | 54        |
| 8     | 0   | 7     | 53    |       | 21  | 8000           | 10         | 24     | 49    | 16    | 27        |
| 9     | 0   | 8     | 52    | 13    | 32  | 9000           | 7          | 20     | 25    | 26    | 1         |
| 10    | 0   | 9     | 51    | 21    | 42  | 10000          | 4          | 16     | 1     | 35    | 34        |
| 20    | 0   | 19    | 42    | 43    | 23  | 20000          | 9          | 2      | 3     | 11    | 8         |
| 30    | 0   | 29    | 3 1   | 5     | 5   | 30000          | 1          | 18     | 4     | 46    | 42        |
| 40    | 1   | 9     | 25    | 26    | 47  | 40000          | 6          | 4      | 6     | 22    | 16        |
| 50    | 1   | 19    | 16    | 48    | 29  | 50000          | 10         | 20     | 7     | 57    | 50        |
| 60    | 1   | 29    | 8     | 10    | 10  | 60000          | 3          | 6      | 9     | 33    | 23        |
| 70    | 2   | 8     | 59    | 31    | 52  | 70000          | 7          | 22     | 11    | 8     | 57        |
| 80    | 2   | 18    | 50    | 53    | 34  | 80000          | 0          | 8      | 12    | 44    | 31        |
| 90    | 2   | 28    | 42    | 15    | 16  | 90000          | 4          | 24     | 14    | 20    | 5         |
| 100   | 3   | 8     | 33    | 36    | 57  | 100000         | 9          | 10     | 15    | 55    | 39        |
| 200   | 6   | 17    | 7     | 13    | 55  | 200000         | 6          | 20     | 31    | 51    | 18        |
| 300   | 9   | 25    | 40    | 50    | 52  | 300000         | 4          | 0      | 47    | 46    | <b>57</b> |
| 400   | 1   | 4     | 14    | 27    | 49  | 400000         | 1          | 11     | 3     | 42    | 36        |
| 500   | 4   | 12    | 48    | 4     | 47  | 500000         | 10         | 21     | 19    | 38    | 16        |
| 600   | 7   | 21    | 21    | 41    | 41  | 600000         | 8          | 1      | 35    | 33    | 55        |
| 700   | 10  | 29    | 55    | 18    | 41  | 70000 <b>0</b> | 5          | 11     | 51    | 29    | 34        |
| 800   | 2   | 8     | 28    | 55    | 39  | 800000         | 2          | 22     | 7     | 25    | 13        |
| 900   | 5   | 17    | 2     | 32    | 36  | 900000         | 0          | 2      | 23    | 20    | 52        |
| 1000  | 1 8 | 25    | 36    | 9     | 33  | 1000000        | 9          | 12     | 39    | 16    | 31        |

Sun's Druva 11° 25° 25' 34" 23" A. Cali yugam 4399 complete.

Generally, for all the Tables contained in this collection where a Druva is given, if you compute the number of natural or Savan days elapsed from the end of the year for which the Druva is given, and add to its Longitude, the Snn, or Planet's motion due to the said number of days, you will have their mean place in the Hindu Zodiac for the proposed day, at mean midnight under the Meridian of Lanca.

TABLE XXI.

Of the mean motion of the Moon, of her Apogee, with Bijah and Node: The Bijah being common to both the latter; but as the Node is taken to move in unlecedentia, its Bijah is subtractive.

| Days.    |            | -          | Moon.        |              |               |    | 5   | Apogee.  | e.       | í          |          | <b>=</b> | Bijah.     |       |          |             | Node.    | <b>e</b> . |     |
|----------|------------|------------|--------------|--------------|---------------|----|-----|----------|----------|------------|----------|----------|------------|-------|----------|-------------|----------|------------|-----|
|          | ŝ          | •          | •            | *            | **            | s. | •   | •        | *        | *          | `        |          | H          | 11.11 |          |             | -        | -          | *   |
| _        | 0          | 13         | 10           | 34           | 55            | 0  | O   | 9        | 40       | 59         | <u> </u> | 0        | 0          | 11    | ; o      | 0           | 63       | 10         | 45  |
| 61       | 0          | 9≈         | <b>≅</b> ₹   | 6            | 44            | 0  | 0   | 13       | c₹       | 22         | °        | 0        | 0          | 16    | 0        | 0           | 9        | ©!         | 99  |
| က        |            | 6          | e:           | <del>†</del> | 36            | 0  | 0   | 03<br>O3 | C1       | 56         | o<br>    | 0        | C          | 33    | C        | C           | 0.       | 25         |     |
| *        | ~          | <b>6</b> % | <b>4</b> .   | 10           | 28            | 0  | 0   | 9%       | 43       | 55         | 0        | 0        | С          | 4     | 0        | · C         | · 6      | 2          | , Ç |
| 'n       | <b>€</b> ₹ | 73         | 52           | 54           | 20            | 0  | 0   | ლ<br>ლ   | <b>∺</b> | <b>₹</b> € | 0        | 0        | 0          | 53    | 0        | 0           | 15       | 53         | 44  |
| 1        | 6          | -          |              | 8            |               | ١  |     | 1        | 1,       | 1          | } '      |          |            | Ī     |          | 1           |          |            |     |
| <u>-</u> | 7          |            | ز            | <b>?</b> } ' | 2             | >  | )   | 40       | S        | 57         | o<br>    | 0        |            | स्र   | <u> </u> | C           | c<br>C   | 4          | 28  |
| _        | က          | <b>⊙</b> } | <del>_</del> | 4            | 77            | 0  | 0   | 46       | 46       | $^{55}$    | 0        | 0        | -          | 15    | 0        | 0           | Si<br>Si | 15         | 13  |
| S        | ಉ          | 15         | 51<br>₹7     | တ            | 56            | 0  | 0   | ڻ.<br>دن | <u></u>  | 50         | <u> </u> | 0        | -          | 25    | 0        | С           | 25       | 25         | *C  |
| 6.       | ၅          | 23         | 35           | <del></del>  | 49            | 0  | _   | 0        | အ        | 48         | °        | 0        | -          | 36    | · c      | C           | 86       | 36         | 4   |
| 01       | 4          | 11         | 45           | 48           | _<br> -<br> † | 0  | =   | 0        | 40       | 47         | 0        | 0        | -          | 47    | 0        | 0           | <u> </u> | 47         | 27  |
|          |            |            |              |              |               |    |     |          |          |            |          |          |            |       |          |             |          |            |     |
| 50       | 00         | 57<br>CD   | 2            | 37           | 75            | 0  | C\$ | <u>ب</u> | 39       | 34         | 0        | 0        | ಉ          | 33    | 0        | -           | 67       | 9          | 54  |
| ္က       |            | 5          | 17           | 9 <u>≈</u>   | 63            | 0  | 67  | 20       | 80       | 20         | 0        | 0        | 5          | 20    | C        | -           | 5,5      | 66         | 66  |
| 40       | 00         | 17         | က            | 14           | 43            | 0  | 4   | 27       | 19       | 00         | 0        | C        |            | ~     | · C      | 6           | 1        | 0          | 2 4 |
| 20       | ¢.         | <b>8</b> 8 | 49           | 63           | 23            | 0  | S   | ي<br>ب   | တ        | 55         | 0        | · C      | - α        | 5     | ) C      | 10          | . O      | 4 6        | 9 5 |
| 09       | 21         | 10         | ₽.)<br>-}    | 22           | 4             | 0  | ဗ   | 40       | 58       | 43         | _        | · C      | , <u>c</u> | 208   | <b>-</b> | <b>₹</b> 61 | 3 =      | . +        | 7 7 |
| Ì        |            |            |              |              |               |    |     |          | 1        |            |          | •        | 2          | 3     | •        | 2           | 2        | H          | ř   |
| 20       | ပ          | 55         | 0<br>0<br>3  | 40           | 44            | 0  | 4   | 47.      | 48       | 30         | 0        | 0        | 15         | 96    | 0        | 67          | 64       | 33         | 2   |
| <br>02   | 11         | ❖          | ဗ            | 6<br>€       | 55            | 0  | œ   | 54       | .;<br>;  | 17         | 0        | 0        | 7          | 27    | 0        | 4           | 1 7      | 3 =        | 3 5 |
| 06       | et         | 15         | 23           | 13           | 9             | 0  | 10  | -        | χ<br>3   | 4          | 0        | 0        | 1.5        | 59    | 0        | 4           | 46       |            | 5 4 |
| 100      | ~          | C1         | 00           | د            | - 1           | <  | ,   | ¢        | i        | 1          |          |          | ,          |       |          | ,           | •        |            | ۲   |

The same continued.

|        | 11    | 67<br>67 | ゼ   | 30         | 00        | 40             | 61  | 77  | 16       | 48      | 19       | 30   | 58   | 18       | 37      | 27         | 16       | 36        | 55        | .5             | Si<br>Gi | 44            | 59        | 13         | %<br>83    | 48       |
|--------|-------|----------|-----|------------|-----------|----------------|-----|-----|----------|---------|----------|------|------|----------|---------|------------|----------|-----------|-----------|----------------|----------|---------------|-----------|------------|------------|----------|
| 1.     | *     | 54       | 49  | 43         | 88<br>88  | SS.            | 23  | 16  | 16       | 10      | 15       | 10   | 15   | 21       | 56      | <u>ec</u>  | 52       | 43        | 47        | £3             | 46       | 30            | e5        | 56         | 19         | 12       |
| Node.  | `     | 17       | 35  | 53         | Ι         | 53             | 47  | 5   | e.<br>60 | 41      | 59       | 28   | 57   | 56       | 55      | 5          | ري<br>دي | 5.9       | 51        | 20             | 41       | 85<br>23      | 6.5<br>EU | 14         | 3          | 26       |
|        | ۰     | rc.      | 10  | 5          | 15        | 50             | -   | 1   | 13       | 17      | 21<br>21 | 15   | ∞    | 1        | ₹6      | 17         | 10       | <b>67</b> | 56        | 19             | 6        | 66            | 19        | 0          | ତଃ<br>0    | 138      |
|        | š     | 0        | 0   | 0          | 0         | 0              | -   | -   | _        | -       | _        | က    | 5    | 7        | 90      | 10         | 0        | 63        | က         | 5              | 11       | 4             | 101       | 4          | 0          | 97       |
|        | 111   | 45       | 30  | 15         | 3.1       | 46             | 31  | 19  | _        | 46      | 31       | က    | 34   | 9        | 37      | 6          | 40       | =         | 43        | 1.4            | 50       | 43            | 57        | 12         | 98         | 40       |
| ig.    | =     | 17       | 35  | 55<br>35   | Ξ         | 28             | 40  | 4   | 23       | 39      | 57       | 55   | 52   | 20       | 47      | 45         | 43       | =         | 37        | 35             | 10       | 45            | 202       | 9          | 31         | 9        |
| Bijah  | =     | 0        | 0   | 0          | -         | -              |     | 67  | 7        | 63      | 63       | 70   | 00   | =        | 14      | 17         | 20       | 233       | 98        | <b>6</b> 3     | 59       | 58            | 58        | 88         | 57         | 27       |
|        |       | 0        | 0   | 0          | 0         | 0              | 0   | ၁   | 0        | 0       | 0        | 0    | 0    | 0        | 0       | 0          | 0        | 0         | 0         | 0              | 0        | <del></del> 4 | -         | <b>C9</b>  | Ç1         | en       |
|        | ii ii | 57       | 43  | 3.0<br>6.0 | 3.4<br>60 | 14             | 5   | 56  | 47       | 33<br>S | 63       | 57   | 26   | 55       | £3      | 25         | 50       | 49        | 18        | 46             | 85<br>85 | 19            | စ         | 52         | 90<br>90   | 25       |
|        | =     | 17.      | 35  | 53         | 11        | 65             | 47  | 4   | %<br>%   | 40      | 53       | 26   | 55   | 53       | 53      | 20         | 49       | 47        | 46        | 77             | 63       | 4             | 59        | 43         | 58         | 13       |
| Apogee |       | <b>∞</b> | 16  | %<br>₹     | မာ<br>မာ  | 41             | 49  | 58  | 9        | 14      | 3        | 45   | 000  | <u>~</u> | 51      | 17         | 40       | 60        | 56        | 43             | 389      | 50            | 82        | œ          | <b>S</b> 3 | <b>₹</b> |
| Y      | •     | 11       | 23  | က          | 14        | 25<br>73       | Ø   | 17  | 50       | 2       | 20       | 73   | 4    | 25       | 16      | <b>0</b> 0 | 50       | 12        | <u>61</u> | <del>6</del> 2 | ~        | Ξ             | 15        | 10         | 55         | 92       |
|        | v.    | 0        | ٥   | 7          | -         | _              | 61  | CI  | 35       | 67      | ಣ        | ^    | 11   | 21       | 9       | 01         | ~        | 5         | G         | ۲              | 63       | 67            | 4         | <b>₽</b> D | Ö          | 7        |
|        | W.    | 47       | 33  | 19         | ĸ,        | 22             | တ္  | 25  | 7        | 55      | 45       | 30   | 15   | 55       | 40      | 21         | ၁        | 49        | 333       | 91             | 85<br>85 | 49            | 9         | 22         | 68         | 55       |
|        | 2     | 0        | 13  | 20         | 27        | <b>టు</b><br>ట | 40  | 47  | 5.1      | 0       | ۲.       | 15   | 1    |          | جه<br>ج |            |          | 1         |           | 17             |          |               |           |            | €3         |          |
| Moon.  |       | ရာ<br>လ  | 16  | 54         | ಲು<br>33  | 20             | 48  | 98  | ₩        | 43      | -<br> -  | 42   | es   | 77       | 45      | ပ          | 23       | 49        | 0         | 3.             | 37       | 8.J           | 5         | 36         | ~          | 39       |
|        |       | 27       | 25  | 67         | 50        | 33             | 15  | 13  | Ξ        | œ       | ю        | 12   | 19   | 25       | -       | <b>20</b>  | 14       | 10%       | 22        | ဇာ             | 7        | 20            | 14        | 17         | 2.5        | 24       |
|        | 8.    | ^        | ಉ   | 11         | ^         | 60             | ==  | ~   | 60       | 11      | ۲        | 63   | 6    | 4        | C       | ^          | 61       | 6         | 4         | 0              | 0        | 0             | 0         | 0          | 0          | 0        |
| Days.  |       | 100      | 200 | 300        | 400       | 200            | 000 | 200 | 800      | 006     | 1000     | 2000 | 8000 | 4000     | 2000    | 0009       | 7000     | 8000      | 0006      | 10000          | 20000    | 30000         | 40000     | 20000      | 00009      | 70000    |

The same continued.

|         |              | ( 2                                           | 27 )                                                                             | Cali                 | lete.          |
|---------|--------------|-----------------------------------------------|----------------------------------------------------------------------------------|----------------------|----------------|
|         | 43           | 57<br>12<br>26<br>53<br>19                    | 35<br>35<br>35                                                                   | 58<br>25<br>0 A.Cali | 4399 complete. |
|         | 12           | 50<br>52<br>52<br>37                          | 29<br>22<br>14<br>7<br>7<br>50                                                   | 51                   | 4300           |
| Node.   | 56           | 47<br>937<br>57<br>26<br>26                   | 50<br>50<br>50<br>50<br>50                                                       | 19                   | yug .          |
| Z       | . 138        | 25.<br>25.<br>25.                             | 13<br>20<br>20<br>9                                                              | 16                   |                |
|         | a, eo        | 12880                                         | 01 7 8 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9 9                                       | 75 G O               |                |
|         | 40           | 55<br>9<br>23<br>46                           | 32<br>55<br>18<br>41                                                             | 97<br>50<br>54       | -              |
| e e     | <b>₹ 1</b> 0 | 41<br>17<br>59<br>44<br>37                    | 29<br>21<br>14<br>6<br>57                                                        | 12 th                |                |
| Bijah.  | 27           | 56<br>26<br>55<br>51<br>47                    | 43<br>33<br>35<br>31<br>26                                                       | 27<br>18<br>18       |                |
|         | , es         | 3<br>4<br>1<br>1<br>1                         | 10<br>24<br>29<br>34<br>39                                                       | 444                  |                |
|         | E 65         | 11<br>57<br>44<br>28<br>13                    | 350<br>239<br>23<br>27                                                           | 35 19                | _              |
|         | * E          | 524<br>524<br>524<br>53                       | 50<br>18<br>14<br>41                                                             | 97 %                 | •              |
| Apogee. | 48           | 37<br>27<br>17<br>34<br>52                    | 0 7 4 3 01                                                                       | 37 24                | }              |
| ¥       | 36           | 0 4 8 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2     | s - 1 0 8 0                                                                      | 41 25 7 25           | }              |
|         | . r          | 9 01 00 00 00 00 00 00 00 00 00 00 00 00      | 00700                                                                            | 24 4                 | •              |
|         | - 10         | 88804                                         | 59<br>229<br>224<br>59                                                           | 30 30                |                |
|         | 2 O          | 2 12 28 12 45 8 14 45 8 14 45 8 14 45 8       | 30 5<br>23 4<br>16 2<br>19 2<br>1 5                                              |                      |                |
| Ė       | İ            | 35 35 45 5 38 38 38 38 38                     | ł                                                                                |                      |                |
| Moon.   | 200          | 10<br>41<br>12<br>25<br>38                    | 51<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17<br>17 | 1 1 7                |                |
|         | . 42         | 150                                           | 20 20 11 11 11 11 11 11 11 11 11 11 11 11 11                                     | 16 22                |                |
|         | .0           | 066                                           | 40180                                                                            |                      | :              |
| -       | 1 6          | 10000                                         | 00000                                                                            | 100                  | <del></del>    |
| Days.   | 20000        | 80000<br>90000<br>100000<br>200000<br>\$00000 | 400000<br>500000<br>600000<br>700000<br>800000                                   | 900000<br>1000000    |                |

### TABLE XXII.

Of the Sun's Anomalistic Equation.

N. B.—To find the Argument of this Table, subtract the Sun's mean place from that of his Apogee for the time given.

| •   | •  | 1+0 | )s    | . VIs | +  | [s   | VII       | + 9 | 2    | VIII  | •    |    |
|-----|----|-----|-------|-------|----|------|-----------|-----|------|-------|------|----|
|     |    | •   | ,     | //    | •  | -,   | "         | •   | ,    |       |      |    |
| 0   | 0  | 0   | 0     | 0     | -1 | 6    | 3         | 1   | 53   | 26    | 30   | 0  |
| 3   | 45 | 0   | 8     | 44    | 1  | 13   | 18        | 1   | 57   | 22    | 26   | 15 |
| . 7 | 30 | 0   | 17    | 24    | 1  | 20   | 13        | 2   | 0    | 50    | 22   | 30 |
| 11  | 15 | 0   | 25    | 58    | 1  | 26   | 47        | 2   | 3    | 46    | 18   | 45 |
| 15  | 0  | 0   | 5.1   | 24    | 1  | 32   | 57        | 2   | 6    | 11    | 15   | O  |
| 18  | 45 | 0   | 42    | 33    | 1  | 38   | 44        | 2   | 8    | 4     | . 11 | 15 |
| 22  | 30 | 0   | 50    | 40    | 1  | 44   | 5         | 2   | 9    | 26    | 7    | 30 |
| 26  | 15 | 0   | 58    | 29    | 1  | 48   | <b>59</b> | 2   | 10   | 15    | 3    | 45 |
| 30  | 0  | 1   | 6     | 3     | 1  | 53   | 26        | 2   | 10   | 31    | 0    | C  |
| •   |    |     | XIs . | + .Vs |    | X, - | - IV'     |     | 1X - | - III | •    | ,  |

TABLE XXIII.

of the Moon's Anomalistic Equation.

N. B ... To find the Argument, subtract the Moon's mean place from that of her Apogee.

| •  | •  | + ( | )s   | $VI_{5}$  | + | [s   | VIIs       | + 11 | ۰    | VIIIs | •  | ,  |
|----|----|-----|------|-----------|---|------|------------|------|------|-------|----|----|
|    |    | •   | 1    | <i>u</i>  | • |      | "          | •    | .,   | "     |    |    |
| 0  | 0  | 0   | 0    | 0         | 2 | 32   | 0          | 4    | 22   | 30    | 30 | 0  |
| 3  | 45 | 0   | 19   | <b>59</b> | 2 | 48   | 48         | 4    | 31   | 46    | 26 | 15 |
| 7  | 30 | 0   | 39   | 52        | 3 | 4    | 52         | 4    | 39   | 56    | 22 | 30 |
| 11 | 15 | 0   | 59   | 31        | 3 | 20   | 8          | 4    | 46   | 50    | 18 | 45 |
| 15 | 0  | 1   | ,13  | 54        | 3 | 34   | 30         | 4    | 52   | 32    | 15 | 0  |
| 13 | 45 | 1   | 37   | 53        | 3 | 48   | 1          | 4    | 56   | 59    | 11 | 15 |
| 22 | 30 | 1   | 56   | 25        | 4 | 0    | 33         | 5    | 0    | 13    | 7  | 30 |
| 26 | 15 | 2   | 11   | 29        | 4 | 12   | 3          | 5    | 2    | 9     | 3  | 45 |
| 30 | 0  | 2   | 32   | 0         | 4 | 22   | <b>3</b> 0 | 5    | 2    | 46    | 0  | 0  |
| •  | ,  |     | XIs. | + V5      |   | Xs - | - IVs      | -1   | X' - | + 111 | •  |    |

# TABLE XXIV.

### OF MARACANDA.

Solar Equations.

Ravi P'hala.

Extracted from Mr. Davis' Paper on the Astronomical Computations of the Hindus.

Asiat. Res. Vol. II, page 255.

ARGUMENT, THE SUN'S ANOMALY.

| Anomaly. | Equation the mean true pl | to the     | of the |             | Anomaly. | the m | ation<br>ean to<br>e plac | o the | of the | ation<br>mean<br>true |    | the<br>th |               | n to<br>ue | on o<br>mea<br>the | rati- of the on to true tion. |
|----------|---------------------------|------------|--------|-------------|----------|-------|---------------------------|-------|--------|-----------------------|----|-----------|---------------|------------|--------------------|-------------------------------|
|          | • /                       | #          | 1      | •           |          | •     | -,                        | "     | ,      |                       |    | •         | •             | ,,         | ,                  | "                             |
| 1        | 2                         | 20         | 2      | 18          | 31       | 1     | 8                         |       | 1      | 55                    | 61 | 1         | 54            | 30         | 1                  | 4                             |
| 2        | 4                         | 40         | 2      | 18          | 32       | 1     | 9                         | 57    | 1      | 53                    | 62 | 1         | 55            | 34         | ī                  | οl                            |
| 3        | 7                         |            | 2      | 18          | 33       | 1     | 11                        | 57    | 1      | 53                    | 63 | 1         | 56            | 35         | -                  | 58                            |
| 4        | 9                         | 19         | 2      | 17          | 31       | 1     | 13                        | 47    | 1      | 51                    | 64 | 1         | 5 <b>7</b>    | 34         | ĺ                  | 57                            |
| 5        | 11                        | 37         | 2      | 17          | 35       | 1     | 15                        | 40    | 1      | 51                    | 65 | 1         | 5 <b>8</b>    | 34         |                    | 55                            |
| 6        | 13                        | 56         | 2      | 17          | 36       | 1     | 17                        | 32    | 1      | 49                    | 66 | 1         | 59            | 30         |                    | 55                            |
| 7        | 16                        | 15         | 2      | 16          | 37       | 1     | 19                        | 23    | 1      | 47                    | 67 | 2         |               | 23         | Į                  | 52                            |
| 8        | 18                        | 33         | 2      | 16          | 38       | 1     | 21                        | 11    | 1      | 45                    | 68 | 2 2       | 1             | 14         |                    | 49                            |
| 9        | 20                        | 51         | 2      | 15          | 39       | 1     | 22                        | 57    | 1      | 43                    | 69 |           | 2             | 4          | 1                  | 46                            |
| 10       | 23                        | 7          | 2      | 14          | 40       | 1     | 24                        | 42    | 1      | 42                    | 70 | 2         | 2             | 51         |                    | 43                            |
| 11       | 25                        | 23         | 2      | 14          | 41       | 1     | 25                        | 26    | 1      | 40                    | 71 | 2         | 3             | 35         |                    | 41                            |
| 12       | 27                        | 39         | 2      | 13          | 42       | 1     | 28                        | 7     | 1      | 38                    | 72 | 2         | 4             | 17         |                    | 39                            |
| -13      | 29                        | <b>55</b>  | 2      | 13          | 43       | 1     | 29                        | 46    | 1      | 36                    | 73 | 2         | 4             | 57         | 1                  | 37                            |
| 14       | 32                        | 10         | 2      | 12          | 41       | 1     | 31                        | 23    | 1      | 31                    | 74 | 2         | 5             | 35         | İ                  | 35                            |
| 15       | 31                        | 21         | 2      | 11          | 45       | 1     | 32                        | 58    | 1      | 32                    | 75 | 2         | 6             | 12         |                    | 32                            |
| 16       | 36                        | 3 <b>7</b> | 2      | 11          | 46       | 1     | 34                        | 32    | 1      | <b>3</b> 0            | 76 | 2         | 6             | 45         |                    | 31                            |
| 17       | 33                        | 39         | 2      | 10          | 47       | 1     | 36                        | 4     | 1      | 29                    | 77 | 2         | 7             | 17         | 1                  | 28                            |
| 18       | 41                        | 1          | 2      | 9           | 48       | 1     | 37                        | 35    | 1      | 28                    | 78 | 2         | 7             | 45         | İ                  | 25                            |
| 19       | 43                        | 12         | 2      | 8           | 49       | 1     | 39                        | 6     | 1      | 28                    | 79 | 2         | 8             | 12         |                    | 23                            |
| 20       | 45                        | 22         | 2      | 7           | 50       | 1     | 40                        | 36    | 1      | 26                    | 80 | 2         | 8             | 35         |                    | 22                            |
| 21       | 47                        | 31         | 2      | 6           | 51       | 1     | 12                        | 3     | 1      | 23                    | 81 | 2         | - <u>-</u> -8 | 58         |                    | 20                            |
| 22       | 49                        | 39         | 2      | 6           | 52       | 1     | 43                        | 26    | 1      | 19                    | 82 | 2         | 9             | 18         |                    | 18                            |
| 23       | 51                        | 47         | 2      | 5           | 53       | 1     | 44                        | 45    | 1      | 16                    | 83 | 2         | 9             | 39         | i                  | 15                            |
| 21       | 53                        | 53         | 2      | 3           | 51       | l     | 46                        | 2     | 1      | 14                    | 84 | 2         | 9             | 51         | 1                  | 12                            |
| 25       | 55                        | 57         | 2      | 2           | 55       | 1     | 47                        | 17    | 1      | 13                    | 85 | 2         | 10            | 3          |                    | 10                            |
| 26       | 58                        | 1          | 2      | 1           | 56       | 1     | 48                        | 33    | 1      | 13                    | 86 | 2         | 10            | 13         | 1                  | 8                             |
| 27       | 1 -                       | 2          | 2      | <del></del> | 57       | 1     | 49                        | 47    | 1      | 12                    | 87 | 2         | 10            | 20         | İ.                 | ð                             |
| 28       | 1 2                       | 53         | 1      | 53          | 58       | 1     | 51                        |       | 1      | 11                    | 88 | 2         | 10            | 27         |                    | 4                             |
| 29       | 1 4                       | 3          | 1      | 57          | 59       | 1     | 52                        | 12    | 1      | 11                    | 89 | 2         | 10            | 31         | 1                  | 1                             |
| 30       | 1 6                       | 2          | 1      | 56<br>——    | 60       | 1     | 53                        | 25    | ( 1    | 8                     | 90 | 2         | 10            | 32         | 1                  | 0                             |

These, and preceding Tables, were constructed for the same end. The present are adapted to Maracanda's Rules: the former to Vavilala Cuchinna's, with a different Argument. Attention is to be paid when using Maracanda's, whether the Equation be additive or subtractive. Vavilala's leave no doubt on the subject, but they do not exhibit the Equation from mean to true motion; though the same may be worked by their means.

## TABLE XXV.

Lunar Equations.

Chandra P'hala.

Vide Notes preceding Table.

ARGUMENT, THE MOON'S ANOMALY.

| Anomaly. | the n |            | on of to the ace. | of t<br>mean | to<br>true | d Anomaly. | the | quationean<br>ue pl | to the     | Equa<br>of t<br>mean<br>the<br>moti | true       | Anomaly. | the | uatio<br>mean<br>ue pl | to the           | Equa<br>of t<br>mean<br>the<br>mot | the<br>n to<br>true |
|----------|-------|------------|-------------------|--------------|------------|------------|-----|---------------------|------------|-------------------------------------|------------|----------|-----|------------------------|------------------|------------------------------------|---------------------|
| 2        | Ì     | 10         | 40                | 69           | 38         | 32         | 2   | 41                  | 11         | 58                                  | 41         | 62       | 4   | 27                     | 36               | 30                                 | 39                  |
| 3        |       | 16         |                   | 69           | 33         | 33         | 2   | 45                  | 36         | 58                                  |            | 63       | 4   | 29                     | 59               | 31                                 | 35                  |
| 4        |       | 21         | 19                | 69           | 23         | 34         | 2   | 49                  | 58         | 57                                  | 19         | 64       | 4   | 32                     | 19               | 30                                 | 29                  |
| 5        |       | <b>2</b> 6 | 36                | 69           | 21         | 35         | 2   | 54                  | 20         | 56                                  | 37         | 65       | 4   | 34                     | 37               | 29                                 | 22                  |
| 6        |       | 31         | 54                | 69           | 13         | 36         | 2   | 58                  | 39         | 5 <b>5</b>                          | <b>5</b> 6 | 66       | 4   | 33                     | 47               | 28                                 | 13                  |
| 7        |       | 37         | 12                | 69           | 4          | 37         | 3   | 2                   | 54         | 55                                  | 14         | 67       | 4   | 38                     | 54               | 27                                 | 7                   |
| 8        |       | 49         | 29                | 68<br>68     | 54<br>43   | 38         | 3   | 7<br>11             | 5<br>12    | 54<br>53                            | 30  <br>44 | 68       | 4   | 40<br>42               | 5 <b>4</b><br>50 | 26<br>24                           | 1<br>55             |
| 9        | 1     | 47<br>52   | 44<br>58          | 68           | 28         | 40         | 3   | 15                  | 16         | 52                                  | 58         | 70       | 4   | 44                     | 40               | 23                                 | 49                  |
| <u></u>  |       |            |                   |              |            |            |     | <del>-,</del>       |            |                                     |            |          |     |                        |                  | !                                  |                     |
| 11       |       | 58         | 11                | 68           | 11         | 41         | 3   | 19,                 | 18         | 51                                  | 26         | 71       | 4   | 46                     | 24               | 22                                 | 42                  |
| 12       | 1     | 3          | 23                | 67           | 52         | 42         | 3   | 23<br>27            | 24         | 50                                  | 57         | 72       | 4   | 48                     | 5                | 21                                 | 34                  |
| 13       | 1     | 8<br>13    | 40<br>45          | 67           | 35<br>17   | 43         | 3   | 30                  | 26<br>54   | 50<br>49                            | 48<br>46   | 73       | 4   | 49                     | 38               | 20                                 | 24                  |
| 15       | 1 1   | 18         | 53                | 66           | 55         | 45         | 3   | 34                  | 3 <b>9</b> | 49                                  | 54         | 74       | 4   | $\frac{51}{52}$        | 9<br>53          | 19                                 | 14                  |
| -        |       |            |                   | 1            |            |            | .]  |                     |            |                                     |            | 73       | -   |                        |                  | 10                                 |                     |
| 16       | 1     | 24         |                   | 66           | 38         | 46         | 3   | <b>3</b> 8          | 21         | 48                                  |            | 76       | 4   | 53                     | <b>54</b>        | 16                                 | 51                  |
| 17       | 1     | 29         | 5                 | 66           | 18         | 47         | 3   | 41                  | 58         | 47                                  | 5          | 77       | 4   | 55                     | 6                | 15                                 | 38                  |
| 18       | 1     | 34         | 9                 | 65           | 57         | 48         | 3   | 45                  | 32         | 46                                  | 9          | 78       | 4   | 56                     | 15               | 14                                 | 25                  |
| 19       | 1     | 39.<br>44  | 10<br>9           | 65           | 36<br>14   | 49<br>50   | 3   | 48<br>52            | 59<br>24   | 45<br>44                            | 13<br>19   | 79       | 4   | 57<br>58               | 17<br>13         | 13                                 | 14<br>3             |
| 20       | -     | 44         |                   | 0.5          | 14         | 30         | -   |                     |            | 44                                  | -19        | 80       | 1.  |                        | 13               | 12                                 |                     |
| 21       | 1     | 49         | 17                | 64           | 50         | 51         | 3   | 55                  | 46         | 43                                  | 27         | 81       | 4   | 59                     | 6                | 10                                 | <b>5</b> 3          |
| 5.5      | 1     | 54         | 3                 | 64           | 24         | 52         | 3   | 59                  | 2          | 42                                  | 32         | 82       | 4   | <b>5</b> 9             | 53               | 9                                  | 41                  |
| 23       | 1     | 58         | 3                 | 63           | 56         | 53         | 4   | 2                   | 13         | 41                                  | 37         | 83       | 5   |                        | 27               | 8                                  | 34                  |
| 24       | 2     | 3<br>8     | 47                | 63           | 24<br>53   | 54         | 4   | 5<br>8              | 18<br>18   | 40                                  | 41         | 84       | 5   | 1                      | 8                | 7                                  | 14                  |
| 25       | 2     | <br>       | 35                | 62           | <b>53</b>  | 55         | 4   |                     | 19         | 39                                  | 44         | 85       | 5   | 1                      | 40               | 6                                  | 2                   |
| 26       | 2     | 13         | 22                | 62           | 22         | 56         | 14  | 11                  | 16         | 38                                  | 47         | 86       | 5   | 2                      | 3                | 4                                  | 51                  |
| 27       | 2     | 18         | 6                 | 61           | 48         | 57         | 4   | 14                  | 11         | 37                                  | 50         | 87       | 5   | 2                      | 20               | 3                                  | 40                  |
| 28       | 2     | 22         | 47                | 61           | 13         | 58         | 4   | 17                  |            | 36                                  | 51         | 88       | 5   | 2                      | 36               | 2                                  | 37                  |
| 29<br>30 | 2     | 27         | <b>3</b> 5        | 60           | 35         | 59         | 4   | 19                  | 46         | 35                                  | 43         | 89       | 5   | 2                      | 44               | 1                                  | 41                  |
| 1 30     | 2     | 32         | 2                 | 59           | 56         | 60         | 4   | 22                  | 29         | 34                                  | 48         | 90       | 5   | 2                      | 48               | <u> </u>                           | 1                   |

## TABLE XXVI.

### Being the first of the Vakiam process.

This Table gives the Druva of the Moon's true place and her true motion for every day in a Devaram, or 248. days. Communicated by Audy Sashya Sastra.

| Days.    | Maga     | ,'s F    | hala                     | D's tiue motion in one day. | Days.      | Moor   | '. F          | hala     | D's true<br>motion in<br>one day. | Days.    | Moor   | 1's F    | 1/12/2        | D's true<br>motion in<br>one day. |
|----------|----------|----------|--------------------------|-----------------------------|------------|--------|---------------|----------|-----------------------------------|----------|--------|----------|---------------|-----------------------------------|
|          |          |          |                          |                             | <u>  —</u> |        |               |          | ;                                 |          |        |          | <del></del> . |                                   |
| _        | 8.       | •        | •                        |                             |            | s.     | •             | ,        | / /                               | 1        | 5.     | •        | . '           | (                                 |
| 1 2      | 0        | 12       | 3                        | 723                         | 36         | 3      | 19            | 39       | 807                               | 71<br>72 | 7      | 7        | 51            | 855<br>847                        |
| 3        | 0        | 24<br>6  | 9<br>22                  | 726<br>733                  | 37         | 4      | 3<br>17       | 21<br>15 | 822<br>834                        | 73       | 7      | 21<br>5  | 58            | 837                               |
| 4        | 1        | 18       | 44                       | 742                         | 39         | 5      | 17            | 20       | 845                               | 74       | 8      | 19       | 55<br>40      | 825                               |
| 5        | 2        | 1        | 19                       | 755                         | 40         | 5      | 15            | 33       | 853                               | 75       | 9      | 3        | 10            | 810                               |
| 6        | 2        | 14       | 9                        | 770                         | 41         | 5      | 29            | 51       | 858                               | 76       | 9      | 16       | 25            | 795                               |
| 7        | 2        | 27       | 13                       | 784                         | 42         | 6      | 14            | 10       | 859                               | 77       | 9      | 29       | 21            | 779                               |
| 8        | 3        | 10       | 33                       | 800                         | 43         | 6      | 23            | 27       | 857                               | 78       | 10     | 12       | 8             | 764                               |
| 9        | 3        | 21       | ð                        | 816                         | 44         | 7      | 12            | 37       | 850                               | 79       | 10     | 21       | 39            | 751                               |
| 10       | 4        | 7        | 58                       | 829                         | 45         | 7      | 26<br>        | 39       | 8-12                              | 80       | 11     | 6        | 58            | 739                               |
| 11       | 4        | 21       | 58                       | 840                         | 46         | 8      | 10            | 30       | 831                               | 81       | 11     | 19       | 8             | 730                               |
| 12       | 5        | 6        | 8                        | 850                         | 47 .       | 8      | 24            | 7        | 817                               | 82       | 0      | 1        | 13            | 725                               |
| 13       | 5        | 20       | 25                       | 857                         | 48         | 9      | 7             | 29       | 802                               | 83       | 0      | 13       | 15,           | 722                               |
| 14       | 6        | 4        | 44                       | 859                         | 49         | 9      | 20            | 35       | 786                               | 84       | 0      | 25       | 19            | 724                               |
| 15       | 6        | 19       | 2                        | 858                         | 50         | 10     | 3             | 26       | 771                               | 85       | 1      | 7        | 27            | 728                               |
| 16       | 7        | 3        | 15                       | 853                         | 51         | 10     | 16            | 2        | 756                               | 86       | 1      | 19       | 43            | 736                               |
| 17       | 7        | 17       | 22                       | 847                         | 52         | 10     | 28            | 26       | 744                               | 87       | 2      | 2        | 10            | 747                               |
| 18       | 8        | 1        | 17                       | 835<br>824                  | 53 54      | 11     | 10<br>22      | 40       | 734                               | 88       | 2<br>2 | 14       | 49            | 759                               |
| 19       | 8<br>8   | 15<br>28 | 1<br>29                  | 808                         | 55         | 11     | 22<br>4       | 46<br>49 | 726<br>723                        | 90       | 3      | 27<br>10 | 43            | 774                               |
| 20       |          | 20       |                          |                             |            |        |               |          | 725                               |          |        | 10       | 53            | 790                               |
| 21       | 9        | 11       | 42                       | 793                         | 56         | 0      | 16            | 52       | 723                               | 91       | 3      | 24       | 18            | 805                               |
| 22       | 9        | 24       | 40                       | 778                         | 57         | 0      | 28            | 58       | 726                               | 92       | 4      | 7        | 58            | 820                               |
| 23       | 10       | 7        | 23                       | 763                         | 58         | 1      | 11            | 10       | 732                               | 93       | 4      | 21       | 52            | 831                               |
| 24<br>25 | 10<br>11 | 19<br>2  | 52<br>10                 | 749<br>738                  | 59<br>60   | 1<br>2 | 23<br>6       | 31       | 741                               | 94<br>95 | 5<br>5 | 5        | 56            | 844                               |
| 25       |          |          |                          | ll                          | ļ          |        |               | 5        | 754                               | 95       | 5      | 20<br>   | 8             | 852                               |
| 26       | 11       | 14       | 19                       | 729                         | 61         | 2      | 18            | 52       | 767                               | 96       | 6      | 4.       | 26            | 858                               |
| 27       | 11       | 20       | 24                       | 725                         | 62         | 3      | l             | 55       | 783                               | 97       | . 6    | 18       | 45            | 859                               |
| 28       | 0        | 8        | 26                       | 722                         | 63         | 3      | 15            | 14       | 799                               | 98       | 7      | 3.       | 2             | 857                               |
| 29       | 0        | 20<br>2  | <b>3</b> 0<br><b>3</b> 8 | 724<br>728                  | 64         | 3<br>4 | 28<br>12      | 47       | 813                               | 99       | 7      | 17       | 13            | 851                               |
| 30       | 1        |          |                          | !1                          | 65         | 4      | - <del></del> | 35       | 823                               | 100      | 8      | 1        | 17            | 841                               |
| 31       | 1        | 14       | 55                       | 737                         | 66         | 4      | 26            | 34       | 839                               | 101      | 8      | 15       | 8             | 831                               |
| 32       | 1        | 27       | 23                       | 748                         | 67         | 5      | 10            | 41       | 850                               | 102      | . 8,   | 28       | 47            | 819                               |
| 33       | 2        | 10       | 4                        | 761                         | 68         | 5      | 24            | 59       | 855                               | 103      | 9      | 12       | 10            | 803                               |
| 34       | . 9      | 23       | 0                        | 776                         | 69         | 6      | 9             | 17       | 858                               | 104      | 9      | 25       | 18            | 788                               |
| 35       | 3        | 6        | 12                       | 792                         | 70         | 6      | 23            | 36       | 859                               | 105      | 10     | - 8      | 11            | 773                               |

| Days.                           | Moon's Phala                                         | D's true<br>motion in<br>one dav.        | Days.                                   | Moon                       | 's P                      | halz                       | D's true<br>motion in<br>one day. | Days.                           | Moon                        | 's P                       | leata                      | y's true motion in one day.     |
|---------------------------------|------------------------------------------------------|------------------------------------------|-----------------------------------------|----------------------------|---------------------------|----------------------------|-----------------------------------|---------------------------------|-----------------------------|----------------------------|----------------------------|---------------------------------|
| 106<br>107<br>108<br>109<br>110 | s. ° ' 10 20 48 11 3 14 11 15 28 11 27 36 0 9 39     | 746 1<br>736 1<br>728 1                  | 55<br>56<br>57<br>58<br>59              | s.<br>8<br>8<br>9<br>9     | 5<br>19<br>3<br>16<br>0   | 52<br>46<br>26<br>51       | 844<br>834<br>820<br>805<br>790   | 204<br>205<br>206<br>207<br>208 | s.<br>5<br>5<br>6<br>6<br>7 | 15<br>29<br>13<br>27<br>12 | 7<br>17<br>34<br>53        | 842<br>850<br>857<br>859<br>858 |
| 111<br>112<br>113<br>114<br>115 | 0 21 41<br>1 3 46<br>1 15 53<br>1 23 18<br>2 10 50   | 725   1<br>732   1<br>740   1            | 60<br>61<br>62<br>63<br>64              | 10<br>10<br>11<br>11<br>0  | 12<br>25<br>8<br>20<br>2  | 55<br>34<br>1<br>17<br>25  | 774<br>759<br>747<br>736<br>728   | 209<br>210<br>211<br>212<br>213 | 7<br>8<br>8<br>9<br>9       | 26<br>10<br>24<br>8<br>21  | 24<br>29<br>23<br>5<br>32  | 853<br>845<br>834<br>822<br>807 |
| 116<br>117<br>118<br>119<br>120 | 2 23 36<br>3 6 37<br>3 19 54<br>4 3 26<br>4 17 12    | 781   1<br>797   1<br>812   1<br>826   1 | 65<br>66<br>67<br>68<br>69              | 0<br>0<br>1<br>1<br>2      | 11<br>26<br>8<br>20<br>3  | 29<br>31<br>36<br>46<br>5  | 724<br>722<br>725<br>730<br>739   | 214<br>215<br>216<br>217<br>218 | 10<br>10<br>11<br>11<br>11  | 4<br>17<br>0<br>12<br>25   | 44<br>40<br>21<br>49<br>6  | 792<br>776<br>761<br>748<br>737 |
| 121<br>122<br>123<br>124<br>125 | 5 1 1k<br>5 15 19<br>5 29 34<br>6 13 52<br>6 28 10   | 848 1<br>855 1<br>858 1<br>858 1         | 170<br>171<br>172<br>173<br>174         | 2<br>2<br>3<br>3<br>4      | 15<br>28<br>11<br>24<br>8 | 36<br>20<br>19<br>34<br>4  | 751<br>764<br>779<br>795<br>810   | 219<br>220<br>221<br>222<br>223 | 0<br>0<br>1<br>1            | 7<br>19<br>1<br>13<br>25   | 14<br>18<br>20<br>25<br>34 | 728<br>721<br>722<br>725<br>729 |
| 126<br>127<br>128<br>129<br>130 | 7 12 25<br>7 26 33<br>8 10 32<br>8 24 18<br>9 7 50   | 848<br>839<br>826<br>1<br>812<br>1       | 175<br>176<br>177<br>178<br>179         | 4<br>5<br>5<br>6<br>6      | 21<br>5<br>19<br>4<br>18  | 49<br>46<br>53<br>8<br>27  | 825<br>837<br>847<br>855<br>859   | 224<br>225<br>226<br>227<br>223 | 2 01 3 3 3                  | 7<br>20<br>3<br>16<br>29   | 52<br>21<br>4<br>2<br>15   | 738<br>749<br>763<br>778<br>793 |
| 131<br>132<br>133<br>134<br>135 | 9 21 7<br>10 4 8<br>10 16 54<br>10 29 26<br>11 11 46 | 781 1<br>766 1<br>752 1<br>740 1         | 190<br>181<br>182<br>183<br>184         | 7<br>7<br>8<br>8<br>8      | 2<br>17<br>1<br>15<br>28  | 45<br>0<br>10<br>9<br>57   | 858<br>855<br>850<br>831<br>828   | 229<br>230<br>231<br>232<br>233 | 4<br>4<br>5<br>5<br>6       | 12<br>26<br>10<br>21<br>8  | 43<br>27<br>22<br>29<br>42 | 803<br>824<br>835<br>847<br>853 |
| 136<br>137<br>138<br>139<br>140 | 11 23 58<br>0 6 3<br>0 18 5<br>1 0 8<br>1 12 16      | 725 1<br>722 1<br>723 1                  | 185  <br>186  <br>187  <br>188  <br>189 | 9<br>9<br>10<br>10<br>11   | 12<br>25<br>8<br>21<br>4  | 30<br>49<br>52<br>39<br>13 | 813<br>799<br>783<br>767<br>754   | 234<br>235<br>236<br>237<br>238 | 6<br>7<br>7<br>8<br>8       | 23<br>7<br>21<br>5<br>19   | 0<br>19<br>36<br>46<br>46  | 858<br>859<br>857<br>850<br>840 |
| 141<br>142<br>143<br>144<br>145 | 1 24 30<br>2 6 56<br>2 19 33<br>3 2 26<br>3 15 34    | 746<br>757<br>773<br>788                 | 190<br>191<br>192<br>193<br>194         | 11<br>0<br>0<br>1          | 16<br>28<br>10<br>22<br>4 | 31<br>46<br>52<br>55<br>58 | 741<br>732<br>726<br>723<br>723   | 239<br>240<br>241<br>242<br>243 | 9<br>9<br>10<br>10<br>10    | 3<br>17<br>0<br>13<br>26   | 35<br>11<br>31<br>35<br>25 | 829<br>816<br>800<br>781<br>770 |
| 146<br>147<br>148<br>149<br>150 | 4 12 36<br>4 26 27<br>5 10 31<br>5 24 42             | 819<br>831<br>844<br>851                 | 195<br>196<br>197<br>198<br>199         | 1<br>1<br>2<br>2<br>2<br>3 | 17<br>29<br>11<br>24<br>7 | 4<br>18<br>42<br>18<br>9   | 726<br>734<br>744<br>750<br>771   | 244<br>245<br>246<br>247<br>248 | 11<br>11<br>0<br>0<br>0     | 9<br>21<br>3<br>15<br>27   | 0<br>22<br>35<br>41<br>44  | 755<br>742<br>733<br>725<br>723 |
| 151<br>152<br>153<br>154        | 6 23 18 7 7 36                                       | 859<br>858                               | 200<br>201<br>202<br>203                | 3<br>4<br>4<br>5           | 20<br>3<br>17<br>1        | 15<br>37<br>14<br>5        | 786<br>802<br>817<br>831          |                                 |                             |                            |                            |                                 |

#### TABLE XXVII, PART 1.

Being the second used in the Vakiam, or Solar process, and called by the Tamul Astronomers the Yoghiadi Table, &c.

|        | Solar months. | Dates. | Equation for 8 days in calas. |    |                    | Solar months. | Dates. | Equati.<br>on for 8<br>days in<br>calas. |    |
|--------|---------------|--------|-------------------------------|----|--------------------|---------------|--------|------------------------------------------|----|
| 1      | Chaitram.     | 1      | 11                            | 0  | 7                  | Arpesi.       | 1      | 1                                        | 6  |
| 1 r 1  |               | 9.     | 14                            |    |                    | `+·           | 9      | 2                                        | )  |
| 1 1    | ОГ            | 17     | 16                            |    | 1                  | or            | 17     | 3                                        |    |
|        | Vaisa'cha.    | 25     | 17                            |    |                    | Cartica.      | 25     | 5                                        |    |
| 2      | Vyassei.      | 1      | 19                            | 1  | 8                  | Cartiga.      | 1      | 6                                        | 7  |
| וטו    | ·             | 9      | 21                            |    | m                  | +             | 9      | 8                                        |    |
| 1 1    | or            | 17     | 22                            |    | 1 1                | or            | 17     | 9                                        | i  |
|        | Jaisht'a.     | 25     | 24                            |    |                    | Margasiras.   | 25     | 10                                       |    |
| 3      | Auni.         | 1      | 24                            | 2  | 9                  | Margali.      | 1      | 10                                       | 8  |
| l II l |               | 9      | 25                            | 1  | 1 1                | +             | .9     | 11                                       |    |
| 1 1    | or            | 17     | 25                            | 1  |                    | or            | 17     | 11                                       |    |
|        | A'shád'ha.    | 25     | 2-1                           |    |                    | Paushia.      | 25     | 11                                       |    |
| 4      | Audi.         | 1      | 21                            | 3  | 10                 | Tye,          | 1      | 11                                       | 9  |
| 95     |               | 9      | 23                            | li | VS                 | +             | 9      | 9                                        |    |
| ) [    | or            | 17     | 22                            |    | 1 1                | or            | 17     | 8                                        |    |
|        | Sravana.      | 25     | 21                            |    |                    | Magha.        | 25     | 7                                        |    |
| 5      | Auvani.       | 1      | 19                            | 4  | 11                 | Maussi.       | 1      | 6                                        | 10 |
| B      |               | 9      | 17                            |    | ***                | +             | 9      | 4                                        |    |
| 1 1    | or            | 17     | 15                            |    | , ,                | or            | 17     | 2                                        |    |
|        | Bha'dra.      | 25     | 13                            |    |                    | Phalguna.     | 25     | 0                                        |    |
| 6      | Paratasi.     | 1      | 11                            | 5  | 12                 | Poongoni.     | 1      | 2                                        | 11 |
| me     |               | 9      | 8                             |    | $\mid \times \mid$ |               | 9      | 4                                        | 1  |
| 1 1    | or            | 17     | 6                             |    | 1 1                | or            | 17     | 7                                        |    |
| 1 1    | Aswina.       | 25     | 3                             |    | 11                 | Chitra.       | 25     | 10                                       |    |

How to find by this Table the Equation due to any proposed day.

- 10 Convert the number of months and days elapsed since the origin Chaitram, the former into their respective signs, the latter into degree.
- 20 If the month began in the day (after Sun rise) deduct the guddias as calas, which are wanting to complete the day on which the month began, whatever be the date in the said month for which you work. And if it commenced during the night, add the same. Or if during day time subtract 1 degree; and add the complement of initial root to 60 guddias converted into calas.
- 30 To find the Equation for one day. Divide the Equation given in the Table by 8; and either add or subtract the quotient, as the given month may require. That is, add from the beginning of Arpesi to the end of Maussi; and subtract from the beginning of Poongoni to the end of Paratasi. Multiply the Equation for one day by the number of days you require in the interval of 8 days; the product is the Equation required. The calas registered in the 4th column, are the sum of the Equations for 8 days given in advance. Thus 11 calas found opposite to 1st Chaitram, shew that on the 8th day of that month, 11 calas will be due.

### TABLE XXVII, PART 2.

Containing the Arguments of the Sun's Anomalistic Equation for the first day of every month in the year; and for finding the same, add his true diurnal motion for every day in each month by Table XXII or XXIV.

| Sig      | 115.     | 1          | )                          | }                                    | jo                | <u> </u> |    |       | <del></del> |                                  |                            |                                                   |
|----------|----------|------------|----------------------------|--------------------------------------|-------------------|----------|----|-------|-------------|----------------------------------|----------------------------|---------------------------------------------------|
| Current. | omplete. | Types.     | Tamul names, Solar months. | Bengal<br>names,<br>Solar<br>months. | Quadrant Anomaly. |          |    | lativ |             | the 1st of each<br>his Apogee or | ⊙'s<br>Equa-<br>tion.<br>± | O's true diurnal motion than his mean, or 59' 8". |
| 1-       |          | -          |                            |                                      |                   | S.       | •  | ,     | ٠           |                                  |                            |                                                   |
| 1 1      | 12       | $ \gamma $ | Chaitram                   | Vaisa'cha                            |                   | 2        | 17 | 17    | 20,         | Supplement of                    | +                          |                                                   |
| 2        | î        | 8          |                            | Jaish'ta                             | IV                | 1        | 17 | 17    | 20\$        | Anomaly to                       | +                          |                                                   |
| 3        | 2        | II         |                            | A'sha'd'ha                           |                   | 0        | 17 | 17    | 20)         | 360                              | ++                         | - 18th Minimum.                                   |
| 4        | 3        |            | Audi                       | Sravana                              |                   | 0        | 12 | 42    | 40)         |                                  |                            |                                                   |
| 5        | 4        | 2          | Auvani                     | Bha'dra                              | I                 | 1        | 12 | 42    | 40}         | Anomaly.                         |                            |                                                   |
| 6        | 5        |            | Paratasi                   | Aswina                               |                   | 2        | 12 | 42    | 40)         | j                                | -                          | 🗐 18th 1st Mean.                                  |
| 7        | 6        |            |                            | Cartica                              |                   | 2        | 17 | 17    | ,           | Distance from                    |                            | - <del></del>                                     |
| 8        | 7        | m          | Cartiga                    | Margasiras                           | II                | 1        | 17 | 17    | 20}         | Perigee.                         |                            | <b>+</b>                                          |
| 9        | 8        | 1          | Margali                    | Paushia                              | 1                 | 0        | 17 | 17    | 20)         | i                                | 7+                         | + 18th Maximum.                                   |
| 10       |          |            | Tye                        | Mágha                                |                   | 0        | 12 | 42    | ,           | Distance from                    |                            | <del> </del>                                      |
| 111      | 10       | 1 200      | Maussi                     | Phalguna.                            | III               | 1        | 12 | 42    | 405         | Perigee.                         | +                          | +                                                 |
| 12       | 11       | ×          | Poongoni                   | Chitra                               | 1                 | 2        | 12 | .12   | 40)         | +                                | + 1                        | ± 18th 2d Mean.                                   |

Explanation and use of the 2d Part.

This second part of Table XXVII was constructed for the purpose of finding the Sun's Anomalistic Equation, his true diurnal metion, his Arca Bhagábala, and that of the Moon, for any day in the year; which the first only supplies in part.

The quantities registered in the 5th column are the Arguments of the Sun's Equation for the first day of every month, to be used either with Table XXII (of Vavilala Cuchinna) or XXIV (of Maracanda).

The positive and negative Signs proper to the Equation sought, are to be taken as given in the 6th column and not as in the Tables referred to, observing that they pass from + to — on or near the 13th of Auni; and from — to + about the 18th Margali, for the reasons given in the second Part of the Key to the Siddhanta Chandra Mana; Article 2, page 127. (\*)

For obtaining the Sun's Equation and diurnal motion on the intermediate days of each month, his mean motion for days (as given in Table XX) is to be applied  $\pm$  to the Argument of the first day as it goes on increasing or decreasing in that particular Quadrant of Anomaly.

The positive and negative Signs registered in the 7th column, indicate whether the Sun's true be greater or less than his mean diurnal motion, or 59' 8". And the Equation referring thereto in Tables XXII or XXIV (to be obtained by the same Argument) are to be used accordingly, without any regard to the Signs exhibited in those Tables.

The whole of the second part of Table XXVII is computed for the beginning of the 4941st Solar year of the Cali yug (11th April A. D. 1839) when the Sun's Apogee, according to Hindu theory, will lie in 2'17°17'20" from the beginning of the Solar Sydereal Zodiac; but it may be adapted to any position of the Sun's Apsis, as follows:

As the Apogee is supposed to move at the rate of 1' in 517 years, its distance from the first point in Mesha  $\gamma$  will be 2" 17' 17' 20" + 1' in the year 4940 + 517 complete, for the same reason that it was 2' 17° 17' 20" - 1' in the year 4940 - 517. That and all other Arguments are therefore to be rectified on the same scale by a rule of proportion.

But as in the 5th column, the ©'s place is given relatively to his Apogee and Perigee, the increment so obtained is to be added in the 4th and 2d; and subtracted in the 1st and 3d Quadrants of Anomaly, and the contrary if it be a decrement, or for anterior times.

#### EXAMPLE.

Let the Sun's Equation, true diurnal motion, and Arca Bhagábala, as well as that of the Moon, be required for the 15th Chaitram complete of the 4941st year of the Cali yug current.

with which Argument, referring to Maracanda's Table (XXIV) we find the Sun's Anomalistic Equation 1° 56′ 4″, which is positive on account of the sign + in the 6th column of the present Table, and according to the well known precept the Solar Arca Bhagábala will be  $+\frac{1^{\circ} 56' 4''}{365} = +19''$ 

and the Lunar - 
$$\frac{1^{\circ} \cdot 56' \cdot 4''}{27} = + 4' \cdot 17'$$
.

The Equation of the Sun's true to mean motion, answering to the same Argument in the same Table, is - - - - 59"

O's mean motion - 59 8
Sun's true diurnal motion, 15th Chaitram - 58 9

N. B.—It is to be understood, however, that both parts of Table XXVII only give approximations, with which the Tamul Astronomers are contented.

### TABLE XXVIII.

Of the Sun's true motion for 366 days, (3d of the Vakiam). Communicated by R. Audy Sashya Brahmini.

| 1   | γ     |         | 1   | ď          |         | 1          | П          |            | 1    | 20         |         |     | 83         |         | 1   | my      |       |
|-----|-------|---------|-----|------------|---------|------------|------------|------------|------|------------|---------|-----|------------|---------|-----|---------|-------|
|     | Vais  |         |     | Jaish      | 'ta.    | 1          | A'shác     | l'ha.      |      | Srava      | na      |     | Bha'c      | lra     |     | Aswi    | na    |
| 1   | 01    |         |     | or         |         | 1          | or         |            | }    | or         | 1.      | 1   | or         |         | ١.  | or      |       |
|     | Chait | ram.    |     | Vy as:     | sci.    | i          | Aun        | I.         | !    | Aud        | 11.     |     | Auya       | nr.     | , , | Parata. | SI.   |
| D.  | Tr.   | motion. | D.  | Tr. n      | notion. | D.         | Tr. v      | otion      | D.   | Tr. n      | notion. | D.  | Tr. n      | notion. | υ.  | Tr. me  | otion |
| -   | ,     | *       | -   | ,          | "       | -          | ,          | "          | -    | ,          | "       |     | ,          |         | -   | ,       | ,     |
| 1   | 58    | 40      | 1   | 57         | 38      | ]          | 56         | 59         | 13   | 5 <b>6</b> | 55      | 1   | 57         | 27      | 1   | 58      | 26    |
| 2   | 58    | 38      | 2   | 57         | 36      | 2          | 56         | 58         | 1 5  | 5 <b>6</b> | 56      | ٤   | 5 <b>7</b> | 29      | 1   | 58      | 28    |
| 3   | 58    | 36      | 3   | <b>57</b>  | 35      | 3          | 56         | 5 <b>7</b> | 3    | 56         | 57      | 3   | 5 <b>7</b> | 31      | 3   | 53      | 30    |
| 4   | 58    | 34      | -1  | 57         | 34      | 4          | 56         | 56         | 4    | 56         | 58      | 4   | 5 <b>7</b> | 33      | 1-1 | 58      | 34    |
| 5   | 58    | 31      | 5,  | 57         | 32      | 5          | 56         | 55         | 5    | <b>56</b>  | 59      | 5   | 5 <b>7</b> | 35      | 5   | 58      | 34    |
| 6   | 58    | 23      | 6   | 57         | 31      | 6          | 56         | 51         | E    | <b>57</b>  | 0       | 6   | 5 <b>7</b> | 36      | 6   | 53      | 26    |
| 7   | 5 ⊰   | 25      | 7   | 5 <b>7</b> | 29      | 7          | 56         | 51         | 7    | 57         | 1       | 7   | 57         | 33      | 7   | 58      | 33    |
| 8   | 58    | 23      | 8   | 57         | 27      | 8          | 56         | <i>53</i>  | 8    | <b>57</b>  | 2       | 8   | 57         | 39      | 8   | 53      | 40    |
| 9   | 83    | 21      | 9   | 5 <b>7</b> | 25      | 9          | 56         | 53         | Ģ,   | 57         | 3       | S   | 57         | 41      | 9   | 58      | 42    |
| 10  | 58    | 19      | 10  | 5 <b>7</b> | 24      | 10         | 56         | 52         | 10   | 5 <b>7</b> | 4       | 10  | 57         | 43      | 10  | 53      | 44    |
| 11  | 58    | 17      | 1,1 | 57         | 22      | 11         | 56         | 52         | 11   | 5 <b>7</b> | 5       | 11  | 57         | 45      | 11  | 58      | 46    |
| 12  | 58    | 15      | 15  | 57         | 21      | 12         | 56         | 52         | 12   | 5 <b>7</b> | 6       | 12  | 57         | 46      | 12  | 58      | 48    |
| 13  |       |         | 13  | 5 <b>7</b> | 20      | 13         | 56         | 52         | 13   | 57         | 7       | 13  | 57         | 48      | 13  | 53      | 50    |
| 14  | 58    |         | 14  | 57         | 19      | 14         | 56         | 5 l        | 14   | 5 <b>7</b> | 8       | 14  | 57         | 50      | 11  | 58      | 53    |
| 15  | 58    | -       | 15  | 5 <b>7</b> | 17      | 15         | 56         | 51         | 15   | 5 <b>7</b> | 9       | 15  | 57         | 52      | 15  | 58      | 5δ    |
| 16  |       | -       | 16  | 5 <b>7</b> | 16      | 16         | 56         | 51         | 16   | 5 <b>7</b> | 10      | 16  | 57         | 51      | 16  | 53      | 59    |
| 17  | 58    | 5       | 17  | 5 <b>7</b> | 15      | 17         | <b>56</b>  | 50         | 17   | 57         | 11      | 17  | 5 <b>7</b> | 56      | 17  | 59      | 2     |
| 18  | 53    | 3       | 18  | 5 <b>7</b> | 13      | 18         | 56         | 50         | 18   | 57         | 12      | 18  | 57         | 58      | 18  | 59      | 5     |
| 1   | 1     |         | 11  |            |         |            | Minin      |            |      |            |         | 1   |            |         | 1   |         | an,   |
| 19  | 53    | 1       | 19  | <b>57</b>  | 12      | 19         | 56         | 50         | [19] | 5 <b>7</b> | 13      | 19  | 5 <b>8</b> | O       | 19  | 59      | 3     |
| 20  | 57    | 53      | 20  | 5 <b>7</b> | 11      | 20         | 56         | 50         | 30   | 57         | 14      | 20  | 53         | 2       | 20  | 59      | 11    |
| 21  | 57    | 56      | 21  | 5 <b>7</b> | 10      | ٤1         | 56         | 50         | 21   | 57         | 15      | 21  | 53         | .1      | 21  | 59      | 11    |
| 22  | 57    | 54      | 20  | 57         | 9       | 22         | 56         | 50         | 건인   | 57         | 16      | 22  | 53         | 6       | 55  | 59      | 17    |
| 23  | 57    | 52      | 25  | 5 <b>7</b> | 7       | 23         | 56         | 51         | 23   | 57         | 17      | 23  | 53         | 8       | 22  | 59      | 20    |
| 2 ! | 57    | 50      | 54  | 57         | 6       | 24         | 56         | 51         | 21   | 57         | 18      | 24  | 58         | 10      | 24  | 59      | 23    |
| 2.5 | 57    | 48      | 25  | 5 <b>7</b> | 4       | 25         | 56         | 51         | 25   | 57         | 19      | 25  | 58         | 12      | 25  | 59      | 26    |
| 26  |       | -16     | 26  | 57         | 3       | 26         | 56         | 52         | 26   | 57         | 20      | 26  | 58         | 11      | 20  | 59      | 29    |
| 27  |       | 45      | 27  | 5 <b>7</b> | 2       | 27         | 5 <b>6</b> | 52         | 27   | 57         |         | 27  | 58         | 16      | 27  | 59      | 32    |
| 28  |       | 43      | 2-  | 57         | 1       | 28         | 56         | <b>52</b>  | 28   | 57         |         | 25  | 58         | 18      | 28  | 59      | 35    |
| 60  |       | 41      | 2!  | 57         | 0       | 20         | 56         | 53         | 25   | 57         | 23      | 29  | 58         | 20      | 2!  | 59      | 38    |
| 30  |       | 39      | 30  | 56         | 59      | <b>3</b> ( | 56         | 54         | . 0  | 57         | 21      | 36  | 53         | 22      | 30  | 59      | 40    |
| 31  | 57    | 38      | 31  | 56         | 59      | 31<br>32   | 56<br>56   | 51         | 31   | 5 <b>7</b> | 25      | 31  | 53         | 24      | 31  | 59      | 42    |
| 1_  | i<br> |         |     |            |         | 132        |            | 55         |      |            |         | - 1 |            |         | •   |         | l     |

This Table answers for the beginning of the year 4924 of the Cali yug (A. D. 1822) when the place of the Sun's Apogee in the Hindu Zodiac was 2° 17° 17′ 18″ and its Tropical Longitude (or Ravi Sayana) 3° 7° 7′ 43″. As the Sun's Apogee is supposed to move only at the rate of 1′ in 517 years, the Peninsula Astronomers conceive that it answers sufficiently well for many centuries past and to come, for computing the Kalendar.

| Ī   | <u>^</u><br>Cári |          | ١,  | m<br>Ma'n x | l<br>:si'ra <b>s</b> | 1            | Paus     |                 |                  | V        |           |          | D/ L - / |            | 1    |          | <del>(</del> |
|-----|------------------|----------|-----|-------------|----------------------|--------------|----------|-----------------|------------------|----------|-----------|----------|----------|------------|------|----------|--------------|
|     | Oiri             | _        | 1 ' | பகாது       |                      |              | raus     |                 |                  |          | gha.<br>r |          | P'ha'    | _          |      |          | itra.        |
| İ   | $\mathbf{A}$ rpe |          | 1   | Cart        |                      |              | Marg     | -               |                  | Ty       |           |          | o<br>Mau |            | İ    | Poor     | r<br>goni.   |
| 1_  |                  | <b>.</b> | .   |             |                      | ĺ            |          |                 | _ _              |          |           | _!_      |          |            | _  _ |          | 5011.        |
| D.  | Tr. n            | notion.  | D.  | Tr. 1       | motion.              | D.           | Tr.      | motion          | . D.             | Tr.      | motion    | 1. D.    | Tr. 1    | motio      | n. D | Tr.      | motion.      |
|     | 1                | #        |     | ,           | H                    |              | ,        |                 | -                | 1        | *         | -[       | ,        | #          | _ _  | ,        | "            |
| 1   |                  | 41       | 1   | 60          | 44                   | 1            | 61       | 23              | 1                | 61       | 24        | 1        | 60       | 53         | 1    | 59       | 53           |
| 2   |                  | 46       | 3   | 60          | 46                   | 2            | 61       | 23              | 1 2              | 61       | 23        | 2        | 60       | 51         | 2    | 59       | 51           |
| 3   | _                | 48       |     | 60          | 48                   | 3            | 61       | 21              | 3                | 61       | 22        | 3        | 60       | 49         | 3    | 59       | 49           |
| 4   | 59               | 50       | 1   | 60          | 50                   | 4            | 61       | 24              | 4                | 61       | 21        | 4        | 60       | 47         | 4    | 59       | 46           |
| 5   | 59               | 52       | 5   | 60          | 52                   | 5            | 61       | 25              | 5                |          | 20        | 5        | 60       | 45         | 5    | 59       | 43           |
| 6   | 59               | 5 🛊      | 6   | 60          | 54                   | Ü            | 61       | 25              | 6                |          | 19        | 6        | 60       | 43         | 6    | 59       | 40           |
| 7   | 59               | 53       | 7   | 60          | 56                   | 7            | 61       | 25              | 7                | :        | 18        | 7        | 60       | 41         | 7    | 59       | 37           |
| 8   | 59               | 53       | S   | 60          | 53                   | 8            | 61       | 25              | 3                |          | 17        | 8        | 60       | 39         | 8    | 59       | 3-1          |
| 9   | 60               | 0        | 9   | 61          | 0                    | 9            | 61       | 25              | 9                | ]        | 16        | 9        | 60       | 3 <b>7</b> | 9    | 59       | 31           |
| 10  | 60               | 2        | 10  | 61          | 2                    | 10           | 61       | 26              | 10               |          | 15        | 10       | 60       |            | 10   | 59       | 29           |
|     | 60               | 4        | 11  | 61          | 3 4                  | 11           | 61       | 26              | 111              | 61       | 14        | 11       | 60       | 33         | 11   | 59       | 26           |
| 12  | 60               | 6<br>8   | 13  | 61<br>61    |                      | 12<br>13     | 61       | 26              | 12               |          | 13        | 12       | 60       | 31         | 12   | 59       | 23           |
| 14  | 60<br>60         | 10       | 14  | 61          |                      | 14           | 61       | 26              | 13               | 61       | 12        | 13       | 60       | 29         | 13   | 59       | 20           |
| 151 | 60               | 19       | 15  | 61          | ,                    | 15           | 61<br>61 | $\frac{26}{26}$ | 11<br>15         | 61       | 11        | 1.1      | 60       | 27         | 14   | 59       | 17           |
| 16  | 63               | 11       | 16  | 61          | - 1                  | 16           | 61       | $\frac{20}{26}$ | 16               | 61<br>61 | 10        | 15       | 60       | 25         | 15   | 59       | 14           |
| 17  | 60               | 16       | 17  | 61          | _                    | 17           | 61       | _               | 171              | 0 t      | 9<br>8    | 16<br>17 | 60       | 23<br>21   | 161  | 59       | 11           |
| 1'' | 00               | 10       | - 1 | 01          |                      | 1'           | Maxi     |                 | 11/              | 91       | ٥         | 14/      | CO       | 21         | 17   | 59       | 8            |
| 18  | 60               | 18       | 18  | 61          | 10                   | 18           | 61       | 26              | 18               | 61       | 7         | 18       | 60       | 19         | 18   |          | an.          |
| 19  | 60               | 20       | 19  | 61          | - 1                  | 19           | 61       | 26              | 19               | 61       | 6         | 19       | 60       | 17         | 19   | 59       | 5            |
| 20  | 60               | 22       | 20  | 61          | 1                    | 20           | 61       | 26              | 20               | 61       | 5         | 20       | 60       | 15         | 20   | 59<br>59 | 3            |
| 21  | 60               | 2.1      | 21  | 61          |                      | 211          | 61       | 26              | 21               | 61       | 4         | 21       | 60       | 13         | 21   | 59<br>58 | 1<br>59      |
| 22  | 60               | 26       | 22] | 61          | 14                   | 22           | 61       | 26              | 22               | 61       | 3         | 29       | 60       | 11         | 22   | 58       | 57           |
| 23  | 60               | 28       | 23  | 61          | 15                   | 23           | 61       |                 | 23               | 61       | 2         | 23       | 60       | 9          | 231  | 58       | 55           |
| 24  | 60               | 30       | 24  | 61          | 16                   | 24           | 61       |                 | 2.1              | 61       | ĩ         | 2:       | 60       | 7          | 21   | 58<br>58 | 52           |
| 25  | 60               | 32       | 25  | 61          | 17                   | 25           | 61       | 26              | 25               | 61       | Ō         | 2.5      | 60       | 5          | 23   | 58       | 49           |
| 26  | 60               |          | 50  | 61          |                      | 25           | σı       | 25              | 26               | 60       | 59        | 26       | 60       | 3          | 26   | 58       | 47           |
| 27  | 60               |          | 27  | GI          |                      | 27           | 61       |                 | 27               | 60       | 58        | 27       | 60       | 1          | 27   | 53<br>53 | 45           |
| 28  | 60               |          | 28  | 61          |                      | 23           | 61       | 25              | $2s_1^{\dagger}$ | 60       | 56        | 28       | 59       | 59         | 23   | 53       | 43           |
| 29  | 60               |          | 29  | бl          |                      | 29           | 61       | 25              | 29               | 60       |           | 29       | 59       | 57         | 58   | 58       | 41           |
| 30  | 60               | 42       | 30  | 61          | 22                   | 3 <b>0</b> , | 61       | 25              | 1                |          |           | 30       | 59       | 55         | 30   | 58       | 40           |

TABLE XXIX.

For finding the Epochs of mean Intercalations of Luni-solur months from the year 0 of the Cali yig, to any other time.

| <del></del>                      |    |     |       |          |              |                                         |          |            |          |         |              |
|----------------------------------|----|-----|-------|----------|--------------|-----------------------------------------|----------|------------|----------|---------|--------------|
| ions.                            | þ. | 10  | 20    | င္ပ      | 40           | 50                                      | 0        | 10         | 50       | 30      | 40           |
| calat                            | 9  | 34  | 00    | 45       | 16           | 50                                      | 95<br>73 | 59         | ಟ        | ^       | 41           |
| III<br>Intera                    | á  | 14  | 66    | ຕ        | 87           | 12                                      | 27       | 11         | 93<br>93 | 11      | 25           |
| of I                             | Ä. | G   | 9     | 4        | -            | 11                                      | 00       | ပ          | s.       | -       | 10           |
| III<br>Epochs of Intercalations. | Υ. | 189 | 370   | 569      | 759          | 948                                     | 1138     | 1393       | 8191     | 1708    | 1897         |
| Complete<br>years.               |    | 190 | 380   | 570      | 094          | 949                                     | 1139     | 1329       | 1519     | 1709    | 1898         |
| Periods.                         |    | -   | 64    | 67       | 4            | 5                                       | 9        | 7          | <b>%</b> | G       | 10           |
|                                  |    | •s. | kesi. | 06       | 1=           | 61>                                     | (01      | lo a       | ejo.     | $c^{i}$ |              |
| one.                             |    | 25  | 50    | 15       | 40           | ۍ.                                      | 30       | 55         | 50       | 45      | 01           |
| calati                           | ů  | 27, | 5.4   | 61<br>61 | 40           | 17                                      | 44       | 11         | 39       | 6       | 34           |
| II<br>Interc                     | Ö. | 22  | 14    | ^        | 66           | 53                                      | 71       | 7          | 65       | 53      | <del>-</del> |
| of ]                             | ¥. | 11  | 11    | 11       | 10           | 10                                      | 10       | 10         | 0        | o.      | 6            |
| If Epochs of Intercalations.     | ٧. | 18  | 37    | 26       | 75           | ð                                       | 113      | 133        | 151      | 170     | 189          |
| Complete<br>years.               |    | 19  | 38    | 57       | 92           | 95                                      | 114      | 133        | 152      | 171     | 190          |
| Periods.                         |    | -   | 61    | 6.2      | 4            | 20                                      | 9        | ^          | ∞        | G       | 10           |
|                                  |    |     |       | ers.     | οΛ 6         | ı j                                     | o sə     | Jyel       | <br>)    | . 🕶     |              |
| <u> </u>                         | _  |     | ===   | Ė        |              | =                                       | ==       | ==         | ==:      | ==      | =            |
| ution                            | ÷  | 0   | 55    | 20       | 45           | 40                                      | 30       | \$0        | 12       |         |              |
| ercalations                      | ပ် | 0   | €7    | ~        | 11           | 15                                      | £3.      | <b>6</b> ∮ | 27       |         |              |
|                                  | Ö. | 0   | 16    | 65       | 18           | 4                                       | 20       | 9          | 64<br>64 |         |              |
| I<br>Epochs of In                | X. | 0   | ∞     | 5        | <del>-</del> | 10                                      | 9        | €73        | Ţ        |         |              |
|                                  | χ. | 0   | 63    | χO.      | 90           | 10                                      | 13       | 16         | 18       |         |              |
| Complete.                        |    | 0   | က     | 9        | 6            | ======================================= | 14       | 17         | 19       |         | ~            |
|                                  |    |     | .e1   | λes      | 61           | ni t                                    | ioiss    | <br>:əɔɔ   | as       |         | _            |

N. B .- This Table is subject to an Equation of 3' 50" additive in all cases .- with it the results will tally correctly with those of the Hindu Rule.

How to compute by this Table the mean intercalation due to A. Cali yugam 4923.

| <b>√.</b> 55                              | 5 8                                  | S 8                                | -               |
|-------------------------------------------|--------------------------------------|------------------------------------|-----------------|
| ت.<br>20<br>11                            | 85 <b>85</b>                         | 38                                 | Difference      |
| <b>9.</b> 6.<br>26 20<br>18 11            | =+                                   | 77 77                              | Differ          |
| , o -                                     | 00                                   | ∞ ∞                                |                 |
| Υ.<br>4915<br>8                           | 4923 8 11 32 40<br>+ 3 50            | 4928 8 14 36 30<br>4928 8 14 36 29 |                 |
|                                           |                                      | ge 150).                           |                 |
| Part I                                    | Equation                             | Time of Intercalation - 4          |                 |
| 4023<br>4915                              | <b>∞</b>                             | Time of<br>Time by                 |                 |
|                                           |                                      |                                    |                 |
| <b>.</b> 60 € .                           | 20.                                  | 10                                 | 55              |
| 6. v.<br>41 40                            | 23 20<br>50 50                       | 14 10<br>6 45                      | 20 55           |
| D. c. v.<br>25 41 40                      | 21 23 20<br>12 50 50.                | 4 14 10<br>22 6 45                 | 26 20 55        |
| M. D. G. V.<br>10 25 41 40                | 9 21 23 20<br>11 12 50 50.           | 9 4 14 10<br>9 22 6 45             | 6 26 20 55      |
| Y. M. D. C. Y.<br>1897 10 25 41 40        | 3795 9 21 23 20<br>948 11 12 50 50   | 4741 9 4 14 10<br>170 9 22 6 45    | 4915 6 26 20 55 |
| Y. M. D. G. Y.<br>1898 - 1897 10 25 41 40 | 3795 9 21 23 20<br>• 948 11 12 50 50 | 4741 9 4 14 10<br>- 170 9 22 6 45  | 4915 6 26 20 55 |
| Take Part III for 1898 - 1897 10 25 41 40 | Part III - 948 11 12 50 50.          | Part II - 170 9 22 6 45            | 4915 6 26 20 55 |

TABLE XXX.

Trigonometrical Table, to Radius 3438'.

| Sig | ns.   | spo  |             | 0, or <b>/</b> | 7 I 2                                 | spo      |       | I' or V | II.       | spoi |       | (I, or A | ш.        | Sig | ns.  |
|-----|-------|------|-------------|----------------|---------------------------------------|----------|-------|---------|-----------|------|-------|----------|-----------|-----|------|
| Deg | rees. | Peri | Sines       | Cosines        | V. sines.                             | Per      | Sines | Cosines | V. sines. | Per  | Sines | Cosines  | V. sines. | De  | g.   |
|     | ,     |      | <del></del> | ,              | · · · · · · · · · · · · · · · · · · · |          | ,     | -,      | ,         | -    | ,     |          |           | 0   | ,    |
| 0   | 0     | 0    | 000         | 3438           | 0                                     | 8        | 1719  | 2978    | 460       | 16   | 2978  | 1719     | 1719      | 30  | •    |
| 3   | 45    | 1    | 225         | 3431           | 7                                     | 9        | 1910  | 2359    | 579       | 17   | 3084  | 1520     | 1918      | 2.5 | 1.   |
| 7   | 30    | 2    | 4.19        | 3409           | 29                                    | 10       | 2093  | 2728    | 710       | 18   | 3177  | 1315     | 5123      | 53  | 3    |
| 11  | 15    | 3    | 671         | 3372           | 66                                    | 11       | 2267  | 2585    | 853       | 19   | 3256  | 1105     | 2333      | 18  | 45   |
| 15  | 0     | -1   | 890         | 3321           | 117                                   | 12       | 2431  | 2431    | 1007      | 20   | 3321  | 890      | 2548      | 15  | 0    |
| 18  | 45    | 5    | 1105        | 3256           | 182                                   | 13       | 2585  | 2267    | 1171      | 21   | 3372  | 671      | 2767      | 11  | 15   |
| 22  | 30    | 6    | 1315        | 3177           | 261                                   | 14       | 2728  | 2093    | 1345      | 22   | 3409  | 449      | 2989      | 7   | 30   |
| 26  | 15    | 7    | 1520        | 3084           | 354                                   | 15       | 2859  | 1910    | 1528      | 23   | 3431  | 225      | 3213      | 3   | 45   |
| 30  | 0     | 8    | 1719        | 2978           | 460                                   | 16       | 2978  | 1719    | 1719      | 21   | 3433  | 000      | 3438      | 0   | ()   |
| Deg | rees. | spoi | Sines       | Cosines        | V. sines.                             | iods     | Sines | Cosines | V. sines. | iods | Sines | Cosines  | V. sines. | De  | -g.  |
|     |       | -E   |             | XI' or         | V.                                    | 15<br>15 |       | X' or l | V.        | Per  |       | IX* or   | III.      | Sis | 113. |

Besides the method by continual bissection of an Arc of 30°, and extracting the square root, those who undertake to expound the Surriah Siddhanta have another Rule for computing the common Table of Sines.

The Prathama Jiva, or Sine of the 1st Pinda is supposed equal to the Arc itself; or Sine of 3' 15' =225', the Radius or Sine of 90' being 3438', and the Cosine of the 1st Pinda, or Cosine 3 45' =  $\sqrt{3438^2 - 225^2} = 3431$ .

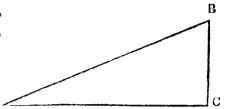
If A=B; A, and A+B be three Arcs, whose common difference  $B=3^{\circ}$  45'. Then the Rule for computing the Table of Sines may be expressed in Algebraical characters as follows: Sine A+B=2 Sine  $\frac{Sine A}{Sine B}$  — Sine AB. Thus let  $A=B=3^{\circ}$  45' or  $A+B=7^{\circ}$  30'. Then Sine  $7^{\circ}$  30' =  $2\times225 - \frac{2\cdot25'}{2\cdot25}$  — Sine  $0^{\circ}=450' - 1=449$ . Next let  $A=7^{\circ}$  30',  $B=3^{\circ}$  45',  $A+B=11^{\circ}$  15'; Then Sine 11° 15' =  $2\times449' - \frac{4\cdot47}{2\cdot25} - 225' = 898' - 2' - 225' = 671'$ . And so on of the whole Quadrant.

To see the reason of this Rule more clearly, suppose again A=B; then Sine 2 B=Sine  $\overline{A+B}$  = 2 Sine B =  $\frac{\text{Sinc B}}{\text{Sine B}}$  = Sine 0°=2 Sine  $\overline{B-1}$ ; and if A be now any Arc whatever, then Sine  $\overline{A+B}$  = 2 Sine A =  $\frac{\text{Sine A}}{\text{Sine B}}$  = Sine  $\overline{A-B}$ , gives Sine  $\overline{A+B}$  + Sine  $\overline{A-B}$  = 2 Sine A =  $\frac{\text{Sine A}}{\text{Sine B}}$  = Sine A ×  $\frac{2 \text{Sine B}}{\text{Sine B}}$  = Sine A ×  $\frac{2 \text{Sine B}}{\text{Sine B}}$  = Sine A × Cosine B.

When the Sines of all the Pindas have been computed, the Versed Sines are easily found by subtracting the Sine of the complement from the Rudius.

When Sines and Cosines only are required, the Indian Rules of Trigonometry appear very seldom to differ from those used by Europeans. But for solving those cases wherein Europeans make use of Tangents, the Indian Rule must necessarily be different, at least in appearance.

10 Let ABC be a plane Triangle, right angled at C, having an oblique angle at A, and one side given, to find the other side, the common Rule is equivalent to this preportion.



Cosine A : Sine A :: AC : CB or Sine A : Cosine A :: CB : AC.

- 20 If the hypothenuse be required from the same data, the Indian rule is equivalent to Cosine A: Radius :: AC: AB or Sine A: Radius :: BC: AB.
- 30 If the sides be given, to find the oblique angles, they first find the hypothenuse.

$$AB = \sqrt{AC^2 + BC^2}$$
, and then  $AB : Badius :: BC : Sine A or  $AB : Badius :: AC : Cosine A$ .$ 

- 4º If the hypothenuse and a side be given, to find the other side they use  $BC = \sqrt{AB^2 AC^2}$ .
- 50 As every oblique angled triangle is equal to the sum or difference of two right angled triangles, a proposition well known to the Hindus, it may be inferred that they know how to apply Trigonometry to the resolution of oblique angled plane triangles; but of this I have met no example.

There is in the French Ethemerides (Conneissance des Tems) for 1808, a curious paper on the Hindu Table of Sines by Mr. Delambre, to which I refer the reader (p. 447). He observes that if in computing the Pindus the Hindu divisor  $\frac{1}{225}$  be used and the Radius at 3438', only the three first would be correct, after which the error would increase rapidly. But if  $\frac{1}{23553}$  be employed, and Radius 3437, 1 be substituted to the former, then the Hindu results would come (with a few and trifling exceptions) the same as exhibited in the preceding Table and as would result from his formula.

$$\triangle$$
 (2) Sine A = -4 Sine 2  $\frac{1}{2}$   $\triangle$  A Sine A = - Chord 2  $\times$   $\triangle$  A  $\times$  Sine A. (\*)

(Vide Decimal Tables, page 43.)

Mr. D. has recomputed the Hindu Trigonometrical Table on the principle that he proposes, and the only sensible differences fell on

| •        |          | Hindu<br>Portunia | French<br>Formula, |                     |
|----------|----------|-------------------|--------------------|---------------------|
| 22<br>26 | 30<br>15 | 1520              | 1520,59            | To Dolling 9407/ 4  |
| 60<br>67 | ()<br>30 |                   | 2977,47<br>3176,30 | To Radius 3437', 1. |

which differences, he observes, are so trifling, that they do not affect his proposition.

The following Problems of Hindu Spherical Trigonometry will illustrate the various cases of Gnomonics given in Part I, Article 8, page 90 and following of the 2d Mémoir.

A. The modern rules make it appear that the people of India at some former period were well acquainted with the theory of Spherical Trigonometry, if they be not acquainted with it at present.

19 Let A B C be a Spherical Triangle, right angled at C, having an oblique angle at A; and a side BC given. To find the other side AC.

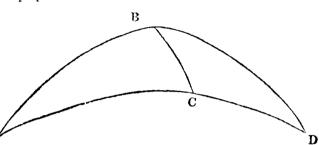
One of their rules is equivalent to these proportions.

First, Sine A: Sine BC:: R:dius:: Sine AB = Rad × Sine BC sine BC sine BC sine BC: Cosine

A:: Sine AB: Sine AC =

Cos. A×Sine AB Ra.×Cos. A×Sine BC

Cosine BC Sine A×Cos. A×Sine BC



This answers to the European method; for Cot. A =  $\frac{\text{Radius} \times \text{Cosine A}}{\text{Sine A}}$ ; and Tang. BC =  $\frac{\text{Radius} \times \text{Sine BC}}{\text{Cosine EU}}$ ; so that Sine AC =  $\frac{\text{Radius} \times \text{Cosine A} \times \text{Sine BC}}{\text{Sine A} \times \text{Sine BC}} = \frac{\text{Co Tang. A} \times \text{Tang. EC}}{\text{Radius}}$ ; which agrees with Napier's Rule.

Another Rule amounts to these proportions, viz.

First. Sine A: Cosine A:: Sine BC: Sine 
$$Z = \frac{\text{Cosine A} \times \text{Sine BC}}{\text{Sine A}}$$
; and

Secondly. Cosine BC: Radius:: Sine Z: Sine  $AC = \frac{\text{Radius} \times \text{Sine } Z}{\text{Cosine BC}} = \frac{\text{Radius} \times \text{Cosine } A \times \text{Sine BC}}{\text{Sine } A \times \text{Cosine BC}}$ the same as before.

When BC is a small Arc, and of course Cosine BC = Radius nearly, the second proportion is omitted; and Sine AC taken equal to Sine  $Z = \frac{\text{Casine A} \times \text{Sine BC}}{\text{Sine A}}$  conformably to the rule in Plane Trigonometry.

20 If the hypothenuse and a side be given, to find the other side, they proceed as follows:

First.  $\sqrt{\text{Sine }^2 \text{ AB} + \text{Sine BC}} = \text{Sine } Z$ . Secondly, Cosine BC : Radius :: Sine Z : Sine  $AC = \frac{\text{Redius} \times \text{Sine Z}}{\text{Cosine BC}} = \frac{\text{Radius}}{\text{Cosine BC}} \times \sqrt{\text{Sine }^2 \text{ AB} + \text{Sine }^2 \text{ BC}}$ .

This is a correct value of Sine AC; for S. <sup>2</sup> AB — S. <sup>2</sup> BC — Cosine <sup>2</sup> BC — Cosine <sup>2</sup> AB; and Sine <sup>2</sup> AC = Radius <sup>2</sup> — Cosine <sup>2</sup> AC; so that Radius <sup>2</sup> — Cosine <sup>2</sup> AC = Radius <sup>2</sup> 

× Cosine <sup>2</sup> BC — Cosine <sup>2</sup> AB or Cosine <sup>2</sup> BC Radius <sup>2</sup> × Cosine <sup>2</sup> BC — Cosine <sup>2</sup> AC × Cosine <sup>2</sup> BC = Radius <sup>2</sup> × Cosine <sup>2</sup> BC — Radius <sup>2</sup> × Cosine <sup>2</sup> AB; that is Cosine <sup>2</sup> AC × Cosine <sup>2</sup> BC = Radius <sup>2</sup> × Cosine <sup>2</sup> AB; and Cosine AC × Cosine BC = Radius × Cosine AB conformably to Napier's rule.

When BC is a small Arc, and Radius = Cosine BC nearly, they omit the second part of the operation, and suppose Sine  $AC = \sqrt{\text{Sine}^2 AB - \text{Sine}^2 BC}$ .

3º Let ABD be an oblique angled Spherical Triangle, in which two sides AB and AD, and the included angle A are given; to find the third side BD. The method is as follows:

Secondly, Sine AD: Sine W:: Radius: Sine 
$$X = \frac{\text{Radius} \times \text{Sine W}}{\text{Sine AD}} = \frac{\text{Rad.} \times \text{Ccs. AB} \times \text{Cos. AD}}{\text{Sine AB} \times \text{Sine AD}}$$

Thirdly, Cosine A + Sine X = Sine Y = 
$$\frac{\text{Cos. } A \times \text{Sine AB} \times \text{Sine AD} + \text{Rad.} \times \text{Cos. } AB \times \text{Cos. } AD}{\text{Sine AB} \times \text{Sine AD}}$$

Fourthly, Radius: Sine Y :: Sine AD : Sine 
$$Z = \frac{\text{Sine } Y \times \text{Sine AD}}{\text{Radius}} =$$

Fifthly, Radius: Sine 
$$Z$$
:: Sine  $AB$ : Cosine  $BD = \frac{\text{Sine } Z \times \text{Sine } AB}{\text{Radius}} = \frac{\text{Sine } Z \times \text{Sine } AB}{\text{Radius}}$ 

This is a correct value of Cosine BD; but sometimes they bring out the same result in another manner, as follows:

First. Find as before Sine W = 
$$\frac{\text{Cosine AB} \times \text{Co-ine AD}}{\text{Sine AB}}$$

Secondly. Find also Sine 
$$X = \frac{\text{Radius} \times \text{Cosine AB} \times \text{Cosine AD}}{\text{Sine AB} \times \text{Sine AD}}$$

Thirdly. Radius + Sine 
$$X = \frac{\text{Radius} \times \text{Sine AB} \times \text{Sine AD} + \text{Radius} \times \text{Casine AB} \times \text{Casine AD}}{\text{Sine AB} \times \text{Sine AD}}$$

Fourthly. Sinc Z — Vers. Sine A = Sine Q — Radius + Cosine A = Sine Y = 
$$\frac{\text{Cosine A} \times \text{Sine AB} \times \text{Sine AD} + \text{Radius} \times \text{Cosine AB} \times \text{Casine AD}}{\text{Sine AB} \times \text{Sine AD}}$$

Lastly. Sine Z, and Cosine BD, are to be found as in the former method.

49. When the three sides of a Spherical Triangle are given, to find an angle A, the foregoing operations are reversed, as follows:

First. Sine AB: Cosine BD:: Radius: Sine 
$$Z = \frac{\text{Radius} \times \text{Cosine BD}}{\text{Sine AB}}$$

Secondly. Sine AD: Sine Z:: Radius: Sine 
$$Y = \frac{\text{Rad.} \times \text{Sine Z}}{\text{Sine AD}} = \frac{\text{Radius } 2 \times \text{Cosine BD}}{\text{Sine AB} \times \text{Sine AD}}$$

Thirdly. Sine AB: Cosine AB:: Cosine AD: Sine W = 
$$\frac{\text{Cosine AB} \times \text{Cosine AD}}{\text{Sine AB} \times \text{Sine AD}}$$

Fourthly. Sine AD: Sine W:: Radius: Sine X = 
$$\frac{\text{Rad.} \times \text{Sine W}}{\text{Sine AD}}$$

Fifthly, Cosine 
$$\Lambda = \text{Sine Y} = \text{Sine X} = \frac{\text{Rodius 2} \times \text{Cosine BD} - \text{Rad. Cosine AB} \times \text{Cosine AD}}{\text{Sine AB} \times \text{Sine AD}}$$

The value of Cosine A thus found is correct, and leaves scarcely any reason to doubt of the people of India being possessed of proper rules for solving all the other cases of Trigonometry, although I have not hitherto met with them.

The preceding Theorems will be found sufficient to demonstrate every case of Hindu Gnomomics, as resolved in the second Memoir of this work.

### A SET OF TABLES

For facilitating the resolution of Astronomical and Gnomonic Problems, according to the theories delivered in the second Memoir.

TABLE XXXI.

For converting parts of the Equator into Indian time and vice versa.

|     | D              | egree <b>s</b> | into Tir | ne.            |                |                            |   |        | l'ime in            | to D | egrees   | •  |          |     |
|-----|----------------|----------------|----------|----------------|----------------|----------------------------|---|--------|---------------------|------|----------|----|----------|-----|
| , , | G.<br>▼.<br>₽. | Y.<br>P.<br>8. | •        | G.<br>∀.<br>P. | ▼.<br>P.<br>S. | Vigud.<br>Paras.<br>Suras. |   | ,<br>H | Vig.<br>Par<br>Sur. | о    | Guddias. | •  | Guddias. | •   |
| 1   | 0              | 10             | 10       | 1              | 40             | 1.                         | 0 | 6      | 10                  | 1    | 1        | 6  | 10       | 60  |
| 2   | 0              | 20             | 20       | 3              | 20             | 2                          | 0 | 12     | 20                  | 2    | 2        | 12 | 20       | 120 |
| 3   | 0              | <b>3</b> 0     | 30       | 5              | 0              | 3                          | 0 | 18     | 30 (                | 3    | 3        | 18 | 30       | 180 |
| 4   | 0              | 40             | 40       | 6              | 40             | 4                          | 0 | 24     | 40                  | 4    | 4        | 24 | 40       | 240 |
| 5   | 0              | <b>5</b> 0     | 50       | - 8            | 20             | 5                          | 0 | 30     | 50                  | 5    | 5        | 30 | 50       | 300 |
| 6   | 0              | 60             | 60       | 10             | O              | 6                          | 0 | 36     | 60                  | 6    | 6        | 36 | 60       | 360 |
| 7   | 1              | 10             | 120      | 20             | 0              | 7                          | 0 | 42     |                     |      | 7        | 42 | 1 :      |     |
| 8   | 1              | 20             | 180      | 30             | 0              | 8                          | 0 | 48     |                     |      | 8        | 48 | l j      |     |
| 9   | 1              | 30             | 240      | 40             | O              | 9                          | 0 | 54     | 11 1                |      | 9        | 54 | 1 1      | í   |
| 10  | 1              | 40             | 300      | 50             | 0              | 10                         | 1 | 0      | 1                   |      | 10       | 60 | ,        | i   |
|     | 1              |                | 360      | 60             | 0              | II                         |   |        | 1                   |      |          |    | i        |     |

### TABLE XXXII.

Shewing the Sun's Declination, Right Ascension and Amplitude, when his Longitude is I, II, and III Signs; which quantities are constant, and applicable to all places.

| Signs. | Sun's   | Longitu | de. |     | Sines. | Su<br>Declin | n's<br>ation. | Sines. | Lagna. | <b>A</b> g | ra. | Sines. |
|--------|---------|---------|-----|-----|--------|--------------|---------------|--------|--------|------------|-----|--------|
|        |         |         |     |     | ,      | •            | ,             | , ,    | ,      | •          | 7   | ,      |
| I      | Yekajya | or Sine | of  | 30° | 1719   | 11           | 43            | 693    | 1670   | 12         | 1   | 716    |
| II     | Duojaya | do.     | of  | 60  | 2978   | 20           | 38            | 1211   | 1795   | 21         | 12  | 1243   |
| III    | Trijaya | do.     | of  | 90  | 3438   | 1 20         | 0             | 1397   | 1935   | 24         | 40  | 1434   |

The Chara Cumda, and Ullagua, are to be calculated for the specific place computed for.

#### TABLE XXXIII.

Exhibiting the Latitudes and Longitudes of certain principal places in India, referred to the Rec'ha or Meridian of Lanca, such as found in some of the Indian Ephemerides annexed to the Solar and Luni-solar Patrus, or Kalendars; the circumference of the Equatorial Circle being = 5059,3 yojanas.

|                |              | 1  |               |               |    |      | Long   | itude | or D       | eseni | ara. |               |
|----------------|--------------|----|---------------|---------------|----|------|--------|-------|------------|-------|------|---------------|
| Names of       | Places.      | •  | itude<br>a Ba | s or<br>gahs. | I  | n De | grees. |       | In '       | Time  |      | In<br>Yojanas |
|                |              | •  | 1             | 7             | •  | ,    | *      | G.    | v.         | ₽.    | s.   |               |
| Delhi          |              | 27 | 35            | o N           | 1  | 16   | 8 E    | +0    | 13         | 0     | o    | 17            |
| Benares        |              | 25 | 38            | 0             | .1 | 37   | ОЕ     | 0     | 46         | 10    | ٠0   | 64            |
| Oogein         |              | 23 | 11            | 30            | 0  | 0    | 0      | 0     | 0          | 0     | 0    | 0             |
| Calcutta.      |              | 22 | 31            | 45            | 12 | 36   | 30 E   | 2     | 6          | 5     | 0    | 177           |
| J              | • •          | 19 | 22            | 0             | 9  | 17   | o E    | 1     | 33         | 0     | 0    | 130           |
| Bomba <b>y</b> |              | 18 | 46            | 40            | 3  | 15   | o W    | 0     | 32         | 30    | 0    | 46            |
| Poona          |              | 18 | 30            | 0             | 1  | 41   | o W    | 0     | 17         | 0     | 0    | _ 21          |
| Chicacole      |              | 18 | 12            | 0             | 8  | 7    | οЕ     | +1    | 22         | 0     | 0    | 114           |
| Vizagapatam    | <del>.</del> | 17 | 42            | 0             | 7  | 32   | 45 E   | 1     | 15         | 27    | 30   | 106           |
| Hyderabad (G   | iolconda) -  | 17 | 26            | 51            | 2  | 58   | 45 E   | 0     | 29         | 47    | 30   | 42            |
| Anagoondy      |              | 16 | 30            | 0             | 0  | 0    | 0      | 0     | 0          | 0     | 0    | 0             |
| Banda near M   | lasulipatam  | 16 | 15            | 0             | 5  | 19   | 45 E   | 0     | 53         | 17    | 30   | 75            |
| Calastri       | -            | 13 | 58            | 0             | 4  | 8    | o E    | 0     | 41         | 0     | 0    | 58            |
| Madras         |              | 13 | 4             | 12            | 4  | 35   | 45 E   | 0     | 45         | 57    | 0    | 65            |
| Bangalore      | • •          | 12 | 56            | 49            | 1  | 42   | 18 E   | 0     | 17         | 3     | 0    | 24            |
| Mangalore      |              | 12 | 51            | <b>3</b> 8    | 1  | O    | 15 M   | _0    | 10         | 2     | 0    | 14            |
| Conjevaram     | · -          | 12 | 51            | 0             | 3  | 59   | o E    | +0    | 40         | 0     | 0 '  | 56            |
| Seringapatam   | • •          | 12 | 32            | 0             | 0  | 5ઇ   | 45 E   | Q     | 9          | 47    | 30   | 14            |
| Pondicherry    | (            | 11 | 55            | 56            | 4  | 0    | 33 E   | O     | 40         | 5     | 30   | 55            |
| Tanjore        |              | 10 | 47            | 0             | 3  | 18   | 9 E    | 0     | 33         | 1     | 30   | 47            |
| Trivalore      |              | 10 | 44            | 0             | 3  | 32   | 58 E   | 0     | 3 <b>5</b> | 29    | 41   | 49            |
| M idura        | , 50         | 9  | 51            | 0             | 2  | 25   | οЕ     | 0     | 94         | 0     | 0    | 31            |
| Ramissuram     |              | 9  | 18            | 7             | 3  | 28   | 50 E   | 0     | 34         | 48    | 45   | 49            |
| Anantachyam    | (Travancore) | 8  | 26            | 0             | 1  | 22   | 0 E    | O     | 11         | 0     | 0    | 19            |

To have the Longitude of any place expressed in yejanas, say, as 360°, to 5059,3, so the given Longitude in degrees, to the distance from the first Meridian counted on the Equator, in yejaras.

N. B.—For fine computations the parts of yejanas either in sexagesimals or decimals must be

accounted for.

#### EXAMPLE I.

The Longitude of Benares in degrees being 4° 37'. Say 360°: 5059,3 :: 4° 37':  $\frac{5059.5 \times 4^{\circ} \, 87'}{360}$  = 64,88 yojanas.

#### EXAMPLE II.

The Longitude of Trivalore in degrees being 3° 32′ 58″. Say 360°: 5059,3 :: 3° 32′ 58″:  $\frac{5059,3 \times 3^{\circ} 32'}{500} = 49,88 \text{ yojanas}.$ 

#### TABLE XXXIV.

Exhibiting the Palabah, or Vishama Chaya, the Shadow of the Gnomon at noon on the days of the Equinoxes, and the circumference of the Circle of Longitude called Seva-desa Paridhi, at some of the principal places in India,—the Equatorial Circle being taken to contain 5059,3 yojanas.

| Names of Places.         | Polar<br>Altitude. | Sines.  | Cosines. | Palabah.     | Seva-desa<br>Paridhi.<br>Circumfer-<br>ence of<br>Circle of<br>Longitude. |
|--------------------------|--------------------|---------|----------|--------------|---------------------------------------------------------------------------|
| _                        |                    |         | i        | <b>A. ∀.</b> |                                                                           |
| Benares                  | 25° 38             | 1487′,0 | 3101',9  | 5 45.1       | 4564',7                                                                   |
| Oogein                   | 23 12              | 1352,3  | 3160,7   | 5 8,0        | 4651,2                                                                    |
| Calcutta                 | 22. 35             | 1319,5  | 3175,0   | 4 59,9       | 4672,1                                                                    |
| Bombay                   | 18 47              | 1106,8  | 3255,3   | 4 4,7        | 4790,4                                                                    |
| Vizagapatam = -          | 17 42              | 1042,8  | 3274,9   | 3 49,2       | 4819,3                                                                    |
| Hyderabad                | 17 27              | 1030,4  | 3278,6   | 3 44,4       | 4824,7                                                                    |
| Banda (near Masulipatam) | 16 15              | 961,6   | 3299,4   | 3 29,8       | 4855,3                                                                    |
| Madras                   | 13 4               | 776,2   | 3347,4   | 2 46,8       | 4925,9                                                                    |
| Bangalore                | 12 57              | 770,2   | 3348,9   | 2 45,5       | 4928,2                                                                    |
| Mangalore                | 12 52              | 765,4   | 3350,1   | 2 44,4       | 4929,8                                                                    |
| Seringapatam             | 12 32              | 745,9   | 3354,6   | 2 40,0       | 4936,5                                                                    |
| Pondicherry              | 11 57              | 711,3   | 3362,7   | 2 32,2       | 4948,4                                                                    |
| Tanjore                  | 10 47              | 643,3   | 3376,7   | 2 17,1       | 4969,1                                                                    |
| Trivalore                | 10 44              | 640,4   | 3377,1   | 2 15,5       | 4969,6                                                                    |
| Ramissuram               | 9 18               | 555,5   | 3391,8   | 1 57,9       | 4991,3                                                                    |

By help of this Table the Lagna, Chara Cumda, and Ullagna of any place therein registered, may be readily computed.

For finding the difference of Longitude in time under any parallel of Latitude, say: As circumference of Circle of Longitude at that place, to 60 guddias, (or dandas), so the Longitude in yojanas counted on the Equatorial Circle, to the difference of Longitude in time of the place computed for,

#### EXAMPLE I.

For Benares, the Longitude of which is 64,88 yojanas East of Lanca.

Table IV. 
$$4564,7:60^{\circ}::64,88$$
 &c.  $:\frac{60\times61,88}{4564,7}=0^{\circ}51^{\circ}10^{\circ}5^{\circ}.$ 

#### EXAMPLE II.

For Trivalore, its Longitude in yojanas being 49,88 &c.

4969,6 : 
$$60^{\circ}$$
 :: 49,88 &c. :  $\frac{60 \times 49,88 \text{ &c.}}{4969,6} = 0^{\circ}$  36' 8' 24'.

#### TABLE XXXV.

Shewing the Ayanansa for Secular years, from A. D. O, to the Julian year 2000, concurrent with the years Cali yugam 3101, and 5101; or 78 years before and 1922 after the birth of Salivahana; giving at the same time the Sun's Ravi Sayana or Longitude at the commencement of each Secular Sydereal year.

| Date in March O. S. | Julian<br>Secular<br>years. | Years expired of the Æra Cali yug. |     | anan    | sa.      |           | Long                  | itude               | •   | Table !  |          |               | g tke<br>years  |        | nansa   |
|---------------------|-----------------------------|------------------------------------|-----|---------|----------|-----------|-----------------------|---------------------|-----|----------|----------|---------------|-----------------|--------|---------|
|                     |                             |                                    |     |         | Secor    | rd Pa     | ıdah.                 |                     |     |          | 1        | . 1           | 1               | _      |         |
|                     |                             | i<br>i                             | ٠   | ,       | "        | ١.        | •                     | ,                   |     | Y.       | 1        | "             | Y.              | •      | _′_     |
| 14                  | 0                           | 3101                               | 7   | 29      | 6        | 11        | 22                    | 30                  | 54  | 1        | 0        | 54            | 70              | 1      | 3       |
| 14                  | 100                         | 3201                               | 5   | 59      | 6        | 11        | 24                    | 0                   | 54  | 2        | 1        | 48            |                 | 1      | 12      |
| 15                  | 200                         | 3301                               | 4   | 29      | 6        | 11        | 25                    | 30                  | 5-4 | 3        | 2        | 42            | 90              | 1      | 21      |
| 16                  | 300                         | 3401                               | 2   | 59      | 6        | 11        | 27                    | 0                   | 54  | 4        | 3        | <b>3</b> 6    | 100             | 1      | 30      |
| 17                  | 400                         | 3501                               | 1   | 29      | 6        | 11        | 23                    | <b>3</b> 0          | 54  | 5        | 4        | 30            | 200             | 3      | 0       |
| 18                  | 499                         | 3600                               | 0   | 0       | 0        | 0         | 0                     | 0                   | 0   | 6        | 5        | 24            | 300             | 4      | 30      |
| 1                   |                             | <br>                               |     |         | hird     | Pad       | ah. (                 | *)                  |     | i  7     | 6        | 15            | 400             | 6      | 0       |
| 18                  | 500                         | 3601                               | +0  | 0       | 54       |           |                       | _                   |     | 8        | 7        | 12            | 500             | 7      | 30      |
| 19                  | 600                         | 3701                               | 1   | 30      | 54       | l .       | 13                    |                     |     | 9        | 8        | 6             | 600             | 9      | 0       |
| 20                  | 700                         | 3801                               | 3   | 0       | 54       |           | Ayanansa<br>the order | <u>.</u>            |     | 10       | 9        | O             | 700             | 10     | 30      |
| 20                  | 800                         | 3901                               | 4   | 30      | 54       |           | nar<br>L              | 3                   |     | 20       | 18       | 0             | 800             | 12     | 0       |
| 21                  | 900                         | 4001                               | 6   | 0       | 54       | 1         | ر<br>خز               | ט                   |     | 30       | 27       | ol            | 1               | 13     | 30      |
| 22                  | 1000                        | 4101                               | 7 9 | 30      | 54       | -         |                       | 5                   |     | 40<br>50 | 36<br>45 | O             | 1000            | 15     | 0       |
| 23                  | 1100                        | 4201                               |     | 0       | 54       |           | ည ဗ                   |                     |     | 1.3      |          | 0             | _               |        |         |
| 24                  | 1200                        | 4301                               | 10  | 30      | 54       | ,         | = 5                   | ភ្ន                 |     | 60       | 54       | Θ             |                 |        |         |
| 25                  | 1300                        | 4401                               | 12  | 0       | 54       | -         | g 3                   | , <u>E</u>          | )   | Date in  | Ī.       |               |                 | _      | _       |
| 26                  | 1400                        | 4501<br>4601                       | 15  | 30      | 54       |           | ָם<br>קר              | S                   |     | AprilNS  |          |               | ily th          |        |         |
| 27                  | 1500<br>1600                | 4701                               | 16  | 0<br>30 | 54       | •         | additive and follows  | the Zodiacal Signs. |     | 5        | yea      | rsare         | given           | in th  | e first |
| 27                  | 1700                        | 4801                               | 18  | 0       | 54<br>54 |           | 2                     | , ii                |     | 6        | pari     | 101           | this            | Tabl   | e, in   |
| 28<br>29            | 1800                        | 4901                               | 19  | 30      | 54<br>54 | 3         | 3 3                   | S N                 |     | 8        |          |               | find            |        |         |
| 30                  | 1900                        | 5001                               | 21  | 0       | 54       | <u>ئر</u> | 7 7                   | به                  |     | 10       | Eur      | opear         | n date          | מו     | oua     |
| 31                  | 2000                        | 5101                               | 22  | 30      | 54       |           | ä                     | <b>4</b>            | i   | 12       | year     | A             | f the           | Cen    | turies  |
| 1 31                | 2000                        |                                    |     | 30      | 94       |           |                       |                     |     | 13       | ad.      | Ayan<br>Aba 1 | iansa<br>beginn | is coi | mput-   |
|                     |                             |                                    |     |         |          |           |                       |                     |     |          | corr     | espor         | oegmi<br>iding  | Hind   | n Che   |
|                     |                             |                                    |     |         |          |           |                       |                     |     |          |          |               | must            |        |         |
|                     |                             |                                    |     |         |          |           |                       |                     |     |          |          |               | of Ta           |        |         |
|                     |                             |                                    |     |         |          |           |                       |                     |     |          | VII      |               | O1 10           | .DIC3  | - 4114  |
|                     |                             |                                    |     |         |          | Eva       |                       |                     |     |          | •        | -             | -               |        |         |

#### EXAMPLE.

How to find the Ayanansa for the year Cali yugam 4846 complete, corresponding to A. D. 1745, on Friday the 9th April N. S.

| Cali yug. | A. D.        | •  | ,          | #   | #  |
|-----------|--------------|----|------------|-----|----|
| 4801      | 1700         | 18 | 0          | 54  |    |
| 40        | 40           |    | <b>3</b> 6 | 0   |    |
| . 5       | . 5          |    | 4          | 30  |    |
| 4846      | 1745         | 18 | 41         | 24  | 0  |
| By the Si | ddhanta Rule | 18 | 41         | 23  | 11 |
|           |              | D  | iffere     | nce | 49 |

<sup>(\*)</sup> In the 3d Quadrant of the Ayanansa, the quantities given in the 4th column shew both the Ayanansa and the Longitude of the 1st point in Mesha Y at the beginning of the year.

## TABLE XXXVI.

Being auxiliary to the XXXVth, for finding the error of the Sun's mean Longitude as computed in the Hindu Solar Tables, when referred to the European Tables.

| Julian<br>Secular<br>years, | Years<br>expired<br>since the<br>Epoch<br>Cali yug. |          |         |          |       | canti I<br>54″ 1‴ |    |      | Га  | ble        | for        | <b>f</b> in | din   | the ,   |       | ınar | ısa f | or | odd      |
|-----------------------------|-----------------------------------------------------|----------|---------|----------|-------|-------------------|----|------|-----|------------|------------|-------------|-------|---------|-------|------|-------|----|----------|
|                             |                                                     |          | ,       | Sec      | ond I | edah.             | ,  |      | l   | 1,         | 4          | 47          | #11   | 1       |       | ,    |       | RI | <b>#</b> |
| 0                           | 3101                                                | 7        | 29      | _<br>16  | 19 1  |                   | 30 | 4.₹  | 1   | ļ 0        | 54         | 1           | 15    | 70      | 1     | 3    | 1     | 26 | 30       |
| 100                         | 3201                                                | 5        | 59      | 14       | 15 1  |                   | 0  | 45   | 2   | 1          | 48         | $\bar{2}$   | 30    | so      | , -   | 12   | î     | 39 | 0        |
| 200                         | 3301                                                | 4        | 29      | 12       | 11    | 1 25              | 30 | 47   | 3   | 2          | 42         |             | 45    | 90      | ,     |      | ī     | 51 | 30       |
| 300                         | 3401                                                | 2        | 59      | 10       | 7,1   | 1 27              | 0  | 49   | 4   | 3          | 3 <b>6</b> | 5           | O     | 100     | 1     | 30   | 2     | 4  | 0        |
| 400                         | 3501                                                | 1        | 29      | 8        | 3 1   | 1 28              | 30 | 51   | 5   | 4          | 30         | 6           | 15    | 200     | 3     | 0    | 4     | 10 | 0        |
|                             | 3600                                                | 0        | 0       | 0        | - ,   | 0 0               | 0  | C    | 6   | 5          | 24         | 7           | 30    | 300     | 4     | 30   | 6     | 15 | 0        |
|                             |                                                     | ĺ        |         |          | rd P  | ıdah.             |    | 1    | 7   | 6          | 18         | 8           | 45    | 400     | 6     | 0    | 8     | 20 | 0        |
| 500                         | 3601                                                |          | +       | 51       | 1     |                   |    | j    | 8   | 7          | 12         | 10          | 0     | 500     | 7     | 30   | 10    | 25 | 0        |
| 600                         | 3701                                                | 1        | 30      | 56       | 6     |                   |    |      | į 9 | 8          | 6          | 11          | 15    | 600     | 9     | 0    | 12    | 30 | 0        |
| 700                         | 3801                                                | 3        | 0       | 58       | 11    | •                 |    |      | 10  | 9          | 0          | 12          | 30    | 700     | 10    | 30   | 14    | 35 | 0        |
| 800 j                       | 3901                                                | 4        | 31      | 0        | 16    |                   |    |      | 20  | 18         | 0          | 24          | 0     | 800j    | 12    | 0    | 16    | 40 | 0        |
| 900                         | 4001                                                | 6        | 1       | 2        | 21    |                   |    | 1    | 30  |            | 0          |             | 30    | 900     | 13    | 30   | 18    | 45 | 0        |
| 1000                        | 4101                                                | 7        | 31      | 4        | 26    |                   |    | 1    | 40  |            | 0          | 49          | 0     | 1000    | 15    | 0    | 20    | 50 | 0        |
| 1100                        | 4201                                                | 9        | 1       | 6        | 31    |                   |    | )    | 50  |            | 1          | 1           | 30    | 1 1     |       |      |       |    |          |
| 1200                        | 4301                                                | 10       | 31      | 8        | 25    |                   |    |      | 60  | 5 <b>4</b> | 1          | 15          | 0     | 1 1     |       |      |       |    |          |
| 1300                        | 4401                                                | 12       | 1       | 10       | 41    |                   |    | - 1  | -   |            |            |             |       |         |       |      |       |    | _        |
| 1400                        | 4501                                                | 13<br>15 | 31<br>1 | 12       | 46    |                   |    | 1    | 7   | (abl       | e 3        | (X)         | χv    | is to I | l'a h | le 3 | vv    | XV | T        |
| 1500                        | 4601<br>4701                                        | 16       | 31      | 14       | 51    |                   |    | 1    | ,   |            |            |             |       |         |       |      |       |    |          |
| 1600  <br>1700              | 4701<br>4801                                        | 18       | 31<br>1 | 16<br>19 | 56    |                   |    | - }  | In  | the        | COI        | star        | ıt ra | tio of  |       | 54#  |       |    | ₹.       |
| 1800                        | 4901                                                | 19       | 31      | 19<br>21 | 6     |                   |    | 1    |     |            |            |             |       |         | 54°   | 1.0  | 1544  |    | ~,       |
| 1900                        | 5001                                                | 21       | 1       | 23       | 11    |                   |    | - 11 | vid | le A       | ppe        | ndi         | x LI  |         |       |      |       |    |          |
| 2000                        | 5101                                                | 22       | 31      | 25<br>25 | 16    |                   |    | -    |     |            | - •        |             |       |         |       |      |       |    |          |

( 48 )
TIDHI TABLE XXXVII.

| Index.   |           | Equation.  | Diurnal | motion. | Index.   | F      | and uation. | Diurnal | motion.  | Index.     |            | Equation.  | Diurnal  | notion.  | Index.          | Pameton  | - Adamin  | Diurnal | metion. |
|----------|-----------|------------|---------|---------|----------|--------|-------------|---------|----------|------------|------------|------------|----------|----------|-----------------|----------|-----------|---------|---------|
| 1        | 2         | 4          | 11      | ø       | 25       | 24     | 29          | 12      | 25       | 43         | 1          | 43         | 13       | 20       | 64              | 21       | 49        | 12      | 10      |
|          | 4         | 7          | 11      | 3       | 23       | 24     | 7           | 12      | 30       | 44         | 3          | 25         | 13       | 20       | 65              | 21       | 48        | 12      | 5       |
| 3        | 6         | 8          | 11      | 5       | 24       | 23     | 37          | 12      | 35       | 45         | 5          | 6          | 13       | 19       | 66              | 24       | 38        | 12      | 0       |
| 4        | 8         | б          | 11      | 7       | 25       | 23     | 1           | 12      | 40       | 46         | . 6        | 45         | 13       | 18       | 67              | 21       | 18        | 11      | 55      |
| 5        | 9         | 59         | 11      | 9       | 26       | 22     | 17          | 12      | 44       | 47         | 8          | <b>2</b> 3 | 13       | 16       | 68              | 23       | 51        | 11      | 50      |
| I        |           |            |         | i       |          |        |             | ļ —     |          |            | iı—        |            |          | <u> </u> | ( <del></del> - | <i>-</i> |           |         | ——I     |
| 6        | <b>11</b> | 49         | 11      | 12      | 27       | 21     | 27          | 12      | 48       | 48         | 9          | 58         | 13       | 14       | 69              | 23       | 15        | 11      | 45      |
| 7        | 13        | <b>3</b> 3 |         | 15      | 28       | 20     | 30          |         | 52       | 49         | 11         | 31         | 13       | 12       | 70              | 22       | 30        | 11      | 40      |
| 8        | 15        | 12         | 11      | 18      | 29       | 19     | 27          |         | 56       | 50         | 13         | 0          | 13       | 9        | 71              | 21       | 37        | 11      | 35      |
| 9        | 116       | 43         |         | 22      | 30       | 18     | 19          | -       | 0        | 51         | 14         | 26         | 13       | 6        | 72              | 20       | 35        | 11      | 30      |
| 10       | 18        | 8          | 11      | 26      | 31       | 17     | 6           | 13      | 3        | 52         | 15         | 48         | 13       | 3        | 73              | 19       | 25        | 11      | 26      |
|          |           |            |         | —-i     |          |        |             |         |          |            |            |            |          |          |                 | }        | <u></u> i |         |         |
| 11       | 19        | 25         |         | 30      | 32       | 15     |             | 13      | 6        | <b>5</b> 3 | 17         | 6          | 13       | O        | 74              | 18       | 8         | 11      | 22      |
| 12       | 20        | 35         |         | 35      | 33       | 14     |             | 13      | 6        | 54         | 18         | 19         |          | 56       | 75              | 16       | 43        | 11      | 18      |
| 13       | 21        |            | 11      | 40      | 34       | 13     |             | 13      | 12       | 55         | 19         |            | 12       | 52       | 76              | 15       | 12        | 11      | 15      |
| 14       | 22        | 30         |         | 45      | 35       | 11     |             | 13      | 14       | 56         | 20         |            | 12       | 48       | 77              | 13       | 33        | 11      | 12      |
| 15       | 23        | 15         | 11      | 5Q      | 36       | 9      | 58          | 13      | 16       | 57         | 21         | 27         | 12       | 4.1      | 78              | 11       | 49        | 11      | 9       |
| 16       |           |            | 11      |         | 97       | -      |             | 1.9     | 16       |            | 90         | 12         | 12       | 40       |                 |          | 50        | 11      | 7       |
| 16<br>17 | 23        | 51<br>18   |         | 55      | 37<br>38 | 8      | 23<br>45    |         | 18<br>19 | 58<br>59   | 22<br>  23 | 17         | 12<br>12 | 40<br>35 | 79              | 9        | 59l       | 11      | 5       |
| 18       | 24        | 18<br>38   |         | 0       | 35       | 6<br>5 | 45          | 13      | 20       | 60         | 23         |            | 12       | 30       | 80              | 6        | 8         | 11      | 3       |
| 19       | 24        | 48         | 12      | 5<br>10 | 40       | 3      | 25          |         | 20       | 61         | 21         | 37         |          | 25       | S1<br>82        | 4        | 7         | 11      | 2       |
| 20       | 24        | 49         | 12      | 15      | 41       | 1      | 43          |         | 21       | 62         | 21         | 29         |          | 20       |                 | 2        | 4         | 11      | 2       |
| 21       | 24        | 43         |         | 20      | 42       | o      | 0           |         | 21       | 63         | 21         | 43         |          | 15       | 83<br>84        | 0        | ان        | 11      | 2       |
| 1 44     | 11-12     | 43         | 12      | 201     | 42       | 10     | - U         | 10      | 21       | 1 03       | 1.24       | 43         | 1.2      | 10.      | 54 I            | ' '      |           | - 1     |         |

## NACSHATRA TABLE XXXVIII.

| Index.              | Equation             |                         | Index.               | Formation            | ry dation.           | Index.               | .,                   | Equation.            | Index.               |                    | Equation.            | Index.               |                      | Equation.            | Index.               | 7                              | rd nation.           | Index.               | Equation, | •                   |
|---------------------|----------------------|-------------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------|----------------------|----------------------|----------------------|----------------------|----------------------|--------------------------------|----------------------|----------------------|-----------|---------------------|
| 1<br>2<br>3         | 2<br>3<br>5<br>7     | 0<br>53<br>54<br>47     | 13<br>14<br>15<br>16 | 20<br>21<br>21<br>22 | 29<br>16<br>53<br>22 | 25<br>26<br>27<br>28 | 20<br>19<br>18<br>17 | 29<br>39<br>42<br>39 | 37<br>38<br>39<br>40 | 4<br>3<br>1<br>0   | 58<br>20<br>40       | 49<br>50<br>51<br>52 | 14<br>15<br>16<br>17 | 1<br>18<br>31<br>39  | 61<br>62<br>63<br>64 | 22<br>22<br>22<br>22           | 58<br>55<br>48<br>22 | 73<br>74<br>75<br>76 | 1         | 0<br>22<br>36<br>47 |
| 5<br>6<br>7<br>8    | 9 11 13 14           | 36<br>21<br>0<br>33     | 17                   | 22 22 22             | 43<br>55<br>58<br>53 | 29                   | 16<br>15<br>14<br>12 | 31<br>18<br>1<br>39  | 41<br>42<br>43<br>44 | 1 3 4 6            | 40<br>20<br>58<br>35 | 53<br>54<br>55<br>56 | 18<br>19<br>20<br>21 | 42<br>39<br>29<br>13 | 65<br>66<br>67<br>68 | 21<br> 21<br> 21<br> 20<br> 19 | 53<br>16<br>29<br>33 | -                    | 5 3 2 0   | 54<br>58<br>0       |
| 9<br>10<br>11<br>12 | 15<br>17<br>18<br>19 | 59,<br>19,<br>30,<br>33 | 22<br>23             | 22<br>22<br>21<br>21 | 39<br>18<br>49<br>13 | 33<br>34<br>35<br>36 | 11<br>9<br>8<br>6    | 12<br>42<br>10<br>35 | 45<br>46<br>47<br>48 | 8<br>9<br>11<br>12 | 10<br>42<br>12<br>39 | 57<br>58<br>59<br>60 | 21<br>22<br>22<br>22 | 49<br>18<br>39<br>53 | 69<br>70<br>71<br>72 | 18<br>17<br>15<br>14           | 30<br>19<br>59<br>33 | <br> <br>            | •         | <br> <br>           |

( 49 )
YOGA TABLE XXXIX.

| Index.      | Equation.  | •        | Diurnal  | motion.    | Index.         | Equation.    |                | Diurnal  | motion.        | Index.         | Equation.      | ,        | Diurnal        | metion.        | Index.         | Equation.      |                | Diurnal        | motion.        |
|-------------|------------|----------|----------|------------|----------------|--------------|----------------|----------|----------------|----------------|----------------|----------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| 1           | 1 3        | 43<br>25 |          | 0<br>1     | 23<br>24       | 21           | 0<br>40        | 14       | 25<br>30       | 45<br>46       | 2 4            | 20       | 15<br>15       | 18<br>17       | 67<br>68       | 21<br>21       | 16<br>3        | 13             | 0<br>55        |
| 2<br>3<br>4 | 5<br>6     | 5<br>43  | 13<br>13 | 5          | 25<br>26       | 20<br>19     | 13<br>40       | 14       | 34<br>39       | 47<br>48       | 5<br>7         |          | 15<br>15       | 16<br>14<br>12 | 69<br>70<br>71 | 20<br>20<br>19 | 43<br>16<br>42 | 13             | 50<br>45<br>40 |
| 5           | 8          |          | 13<br>   | 9          | 27             | 19           | 2<br>          | 14       | 43             | 49<br>         | 8              | 48       | 15             | 10             | 72             | 19             | 1              | 13             | 35             |
| 8           | 11<br>12   | 18<br>41 | 13<br>13 | 12<br>15   | 29<br>30       | 17<br>16     | 35             | 14<br>14 | 51<br>55<br>59 | 51<br>52<br>53 | 11<br>12<br>13 | 4<br>12  | 15<br>15       | 8<br>5         | 73<br>74<br>75 | 18<br>17<br>16 | 19             | 13<br>13<br>13 | 31<br>27<br>23 |
| 10          | 13<br>15   |          | 13<br>13 | 19<br>23   | 31<br>32       | 15<br>14     | 37<br>34       | 14<br>15 | 2              | 54             | 14             | 34       | 14             | 59             | <b>76</b>      | 15             | 11             | 13             | 19<br>15       |
| 11<br>12    | 16<br>17   | 18<br>19 | 13       | 27<br>31   | 33<br>34       | 13<br>12     | 23<br>18       | 15       | 5<br>8         | 55<br>56       | 15<br>16<br>17 | 37<br>35 | 14<br>14<br>14 | 55<br>51<br>47 | 77<br>78<br>79 | 13<br>12<br>11 | 59<br>41<br>18 |                | 12             |
| 13          | 18<br>19   | 13       | 13       | 35<br>40   | 35<br>36<br>37 | 11<br>9<br>9 | 44<br>48<br>29 | 15       | 10<br>12<br>14 | 57<br>58<br>59 | 18<br>19       | 18<br>2  | 14             | 43<br>39       | 80<br>81       | 8              | 50             |                | 7<br>5         |
| 16          | 19         | 16       | .        | 45<br>50   | 38             | 7            | 29             | ·        | 16             | 60             | 19             | 40       | 14             | 34             | 82             | 6              |                | 13             | 3              |
| 17          | 20 21      | 43       | 3 13     | 55<br>O    | 11             | 5<br>4       | 20             |          | 17<br>18       | 62             | 20             | 40       | 14             | 30<br>25<br>20 | 83<br>84<br>85 | 5<br>3<br>1    | 25<br>43       | 13<br>13<br>13 | 1<br>0<br>0    |
| 19<br>20    | 21<br>  21 | 16       |          | 5<br>10    | 41<br>42       | 1            | 54<br>27       | 1 15     | 19<br>19       | 11             | 21             | 14       | 14             | 15             | 86             | ō              |                | 13             | ŏ              |
| 21<br>22    | 21<br>21   | 2        | 1 14     | 15<br>- 20 |                | 0            |                | 15       | 19<br>19       |                | 21<br>21       | 21<br>22 | 14             | 10<br>5        |                |                |                |                |                |

( 50 )

## SOLAR TABLE XL.

| Index.                                         | Equation.                                                     | ·                                | Equation.                          | 1 Diurnal                                           | Arc.<br>Index.                                                                                                  | Equation,                                                       | ½ Diurnal                                                                                               | Index.<br>Equation.                                  | ½ Diurnal                                 |
|------------------------------------------------|---------------------------------------------------------------|----------------------------------|------------------------------------|-----------------------------------------------------|-----------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------------------------------------------------|------------------------------------------------------|-------------------------------------------|
| 1<br>2<br>3<br>4<br>5                          | 0 6 47                                                        | 13 41 4<br>13 41 4<br>13 40 4    | 5   1 30<br>6   1 32<br>7   1 33   | 10 13<br>46 13<br>21 13<br>53 13<br>23 13           | 51 87<br>51 88<br>52 89<br>53 90<br>54 91                                                                       | 2 10 4<br>2 10 14<br>2 10 20                                    | $     \begin{bmatrix}       14 & 35 & 1 \\       14 & 36 & 1 \\       14 & 37 & 1     \end{bmatrix}   $ | 32 1 43 15<br>33 1 41 52                             | 15 28<br>15 30<br>15 31                   |
| 6<br>7<br>8<br>9<br>10                         | 0 13 32<br>0 15 47<br>0 18 1<br>0 20 14<br>0 22 27            | 13 39 5<br>13 39 5               | 0   1 38<br>1   1 39<br>2   1 41   | 23 13<br>48 13<br>11 13                             | \$5         92           \$6         93           57         94           57         95           58         96 | 11                                                              | 14 41 13<br>14 42 13<br>14 41 13                                                                        | 36   1 37 37   1 36 7   8   1 34 37                  | 15 33<br>15 35<br>15 36<br>15 37<br>15 38 |
|                                                | 3 21 39<br>3 26 51<br>0 29 2<br>3 31 13<br>0 33 23            | 13 39 55<br>13 39 5d<br>13 39 57 | 1 45<br>1 46 :                     | 53 13 1<br>13 14<br>30 14<br>46 14<br>J 14          | 59 97<br>0 98<br>1 99<br>2 100<br>3 101                                                                         | 2 10 10<br>2 9 53<br>2 9 45<br>2 9 31<br>2 9 14                 | 14 47 14<br>11 48 14<br>14 49 14                                                                        | 0 1 31 33<br>1 1 29 57<br>2 1 28 21<br>3 1 26 44     | 15 39<br>15 41<br>15 42                   |
| 17<br>18<br>19                                 | 0 37 41                                                       | 13 39 61<br>13 39 62             | 1 51 9<br>1 52 9<br>1 53 9         | 21 14<br>29 14<br>36 14                             | 4 102<br>4 103<br>5 104<br>6 105<br>7 106                                                                       | 2 8 51 1<br>2 8 31 1<br>2 8 11 1<br>2 7 46 1<br>2 7 16 1        | 4 52 142<br>4 53 146<br>4 54 147<br>4 55 148                                                            | 1 23 22 1<br>1 21 40 1<br>1 19 56 1<br>1 18 10 1     | 5 45<br>5 46<br>5 47<br>5 49              |
| 22<br>23<br>24                                 | 0 46 7 1<br>0 48 12 1<br>0 50 16 1<br>0 52 19 1<br>0 54 21 1  | 3 40 65<br>3 40 66<br>3 40 67    | 1 56 3<br>1 57 3                   | 8   14<br>  3   14   14<br>  3   14   1             | 1 110                                                                                                           | 2 6 46 1<br>2 6 16 1<br>2 5 41 1<br>2 5 4 1<br>2 4 27 1         | 1 55 150<br>1 59 151<br>5 0 152<br>5 2 153                                                              | 1 14 35 1<br>1 12 45 1<br>1 10 53 1<br>1 9 1 1       | 5 51<br>5 52<br>5 53                      |
| 27   0<br>28   1<br>29   1                     | - 1                                                           | 3 41 70<br>3 41 71<br>3 42 72    | 2 1 1 2 1 5 2 4                    | 0 14 1;<br>0 14 14<br>7 14 18<br>2 14 16<br>6 14 18 | 3   112<br>1   113<br>5   114<br>6   115                                                                        | 2 3 47 1<br>2 3 4 1<br>2 2 19 1<br>2 1 33 1<br>2 0 46 1         | 5 4 155<br>5 6 156<br>5 7 157<br>5 8 158                                                                | 1 5 14 14<br>1 3 17 15<br>1 1 19 15<br>0 59 21 16    | 5 56<br>5 57<br>5 58<br>6 0               |
| 31   1<br>32   1<br>33   1<br>34   1<br>35   1 | 1 8 5 1<br>1 9 58 1<br>1 11 50 1                              | 3 43 75<br>3 41 76<br>3 44 77    | 2 4 4 6 2 5 2 2 5 5 9              | 5 14 19<br>5 14 23<br>3 14 21<br>14 22<br>14 23     | 117<br>118<br>119<br>120                                                                                        | 1 59 53 15<br>1 58 59 15<br>1 58 5 15<br>1 57 9 15<br>1 56 9 15 | 11 160<br>12 161<br>13 162<br>15 163                                                                    | 0 55 21 16<br>0 53 19 16<br>0 51 17 16<br>0 49 14 16 | 2 2 3                                     |
| 37   1<br>38   1<br>39   1                     | 15 30 13<br>17 17 13<br>1 19 4 13<br>1 20 49 13<br>1 22 32 13 | 3 45 79<br>3 46 80<br>3 47 81    | 2 7 1<br>2 7 31<br>2 8 1<br>2 8 21 | 14 24<br>14 25<br>14 26<br>14 28                    | 122<br>123<br>124<br>125                                                                                        | 1 55 9 15<br>1 54 7 15<br>1 53 4 15<br>1 51 54 15               | 17   165   18   166   20   167   21   168                                                               | 0 45 5 16<br>0 42 59 16<br>0 40 52 16<br>0 38 45 16  | 6<br>7<br>7<br>8                          |
| 41 1 42 1                                      | 1 24 14<br>1 25 54<br>1 27 31                                 | 3 49 84                          | 2 9 4                              | 14 30<br>14 31                                      | 127<br>128                                                                                                      | 1 50 44 15<br>1 49 34 15<br>1 48 24 15<br>1 47 9 15             | 22 170<br>21 171                                                                                        | 0 36 37 16<br>0 34 28 16<br>0 32 18 16<br>0 30 8 16  | 11                                        |

(51)
SOLAR TABLE, continued.

|                                 |                                                                   |                                              |                                                                          | TABLE, 6                             |                                                                                                |                                                                                                               |                                  |
|---------------------------------|-------------------------------------------------------------------|----------------------------------------------|--------------------------------------------------------------------------|--------------------------------------|------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------|----------------------------------|
| Index.                          | Equation.                                                         | Arc. Index.                                  | Equation.                                                                | Arc.                                 | Equation.                                                                                      | Index.<br>Equation,                                                                                           | Diurnal                          |
| 173<br>174<br>175               |                                                                   | 16 12 216<br>16 13 217<br>16 14 218          | 1 5 14 1<br>1 7 8 1<br>1 9 1                                             | 6 19 259<br>6 19 260<br>6 18 261     | 2 4 27 15 40                                                                                   | 303 1 59 2                                                                                                    |                                  |
| 176<br>177<br>178<br>179<br>180 |                                                                   | 16 16 222                                    | 1 10 53 10<br>1 12 45 10<br>1 14 35 10<br>1 16 23 10<br>1 18 10 10       | 6 17 263<br>6 17 264<br>6 16 265     | 2 6 16 15 43<br>2 6 46 15 49<br>2 7 16 15 41                                                   | 306   1 56 38<br>307   1 55 38<br>308   1 54 38                                                               | 8 14 49<br>8 14 48<br>8 14 47    |
| 181<br>182<br>183<br>184<br>185 | 0 7 55<br>0 5 40<br>0 3 21                                        | 16 17 226                                    | 1 19 56 16<br>1 21 40 16<br>1 23 22 16<br>1 25 4 16<br>1 26 44 16        | 14 268<br>14 269<br>13 270           | 2 8 11 15 38<br>2 8 34 15 37<br>2 8 54 15 36<br>2 9 14 15 35<br>2 9 31 15 34                   | 310 1 52 29<br>311 1 51 21<br>312 1 50 11                                                                     | 14 44<br>14 43<br>14 41<br>14 40 |
| 186<br>187<br>188<br>189<br>190 | 0 3 21                                                            |                                              | 1 28 21 16<br>1 29 57 16<br>1 31 33 16<br>1 33 7 16<br>1 34 37 16        | 12 272<br>12 273<br>11 274<br>10 275 | 2 9 45 15 33<br>2 9 58 15 31<br>2 10 10 15 50<br>2 10 17 15 29<br>2 10 22 15 28                | 315   1 46 30<br>316   1 45 13<br>317   1 43 53<br>318   1 42 33                                              | 14 37<br>14 36<br>14 35<br>14 33 |
| 191<br>193<br>193<br>191<br>195 | 0 12.25<br>0 14 40<br>0 16 54<br>0 19 7<br>0 21 20                | 16 20   235<br>16 21   236<br>16 21   237    | 1 36 7 16<br>1 37 37 16<br>1 39 5 16<br>1 40 29 16<br>1 41 52 16         | 10 277<br>8 278<br>8 279<br>7 280    | 2 10 26 15 26<br>2 10 30 15 25<br>2 10 28 15 24<br>2 10 24 15 23                               | 320   1 39 48   321   1 38 23   322   1 36 53   323   1 35 23                                                 | 14 20<br>14 28<br>14 27          |
| Locall                          | 0 23 33 1<br>0 25 45 1<br>0 27 57 1<br>0 30 8 1                   | 16 21 239<br>6 21 240<br>6 22 241            | 1 43 15 16<br>1 44 35 16<br>1 45 52 16<br>1 47 9 16<br>1 48 24 16        | 5 282<br>4 283<br>4 284<br>3 285     | 2 10 20 15 22<br>2 10 14 15 21<br>2 10 4 15 19<br>2 9 52 15 18<br>2 9 39 15 17<br>2 9 24 15 15 | 328 1 27 34 1                                                                                                 | 14 24<br>14 23<br>14 22<br>14 20 |
| 202<br>203<br>204               | 0 34 28 1<br>0 36 37 1<br>0 38 45 1<br>0 40 52 1<br>0 42 59 1     | 6 22 214<br>6 22 245<br>6 22 246<br>6 22 247 | 1 49 34 16<br>1 50 44 16<br>1 51 54 15                                   | 1 287<br>0 288<br>59 289<br>58 290   | 2 9 4 15 14<br>2 8 44 15 13<br>2 8 24 15 12<br>2 8 1 15 10<br>2 7 31 15 9                      | 329   1 25 54 1<br>330   1 24 14 1<br>331   1 22 32 1<br>332   1 20 49 1<br>333   1 19 4 1<br>334   1 17 17 1 | 4 18<br>4 17<br>4 16<br>4 14     |
| 207 (<br>208 (<br>209 (         | 0 45 5 10<br>0 47 10 16<br>0 49 14 16<br>0 51 17 16<br>0 53 19 16 | 5 21 250 251 251 2521                        | 1 55 9 15 5<br>1 56 9 15 5<br>1 57 9 15 5<br>1 58 5 15 5<br>1 58 59 15 5 | 57 292 3<br>56 293 3<br>55 294 3     | 2 7 1 15 8<br>2 6 31 15 7<br>2 5 59 15 6<br>2 5 23 15 4                                        | 335   1 17 17 1<br>335   1 15 30 1<br>336   1 13 40 1<br>337   1 11 50 1<br>338   1 9 58 1<br>339   1 8 5 1   | 4 12<br>4 11<br>4 10<br>4 8      |
| 212   (                         |                                                                   | 20 255 9<br>20 256 9<br>20 257 9             | 2 1 33 15 5<br>2 2 19 15 4                                               | 1 298 2<br>0 299 2<br>9 300 2        | 4 6 15 1<br>3 26 15 0<br>2 42 14 59<br>1 57 14 58                                              | 340 1 6 12 14<br>341 1 4 16 14<br>342 1 2 19 14<br>342 1 0 21 13<br>344 0 53 21 14                            | 4 6<br>4 5<br>4 4<br>1 3         |

( 52 )
SOLAR TABLE, continued.

| Index. | Rangtion | · morrain ha | 1                | ½ Diurnai<br>Arc. | Index. |    | Equation. |    | I Diurnal |    | Index. |   | Equation. |    | 1 Diurnal |    | Index. |    | Equation. |    | J. Diurnal |    |   |
|--------|----------|--------------|------------------|-------------------|--------|----|-----------|----|-----------|----|--------|---|-----------|----|-----------|----|--------|----|-----------|----|------------|----|---|
| 345    | 0 5      | 6 2          | 1 1              | 1 1               | 353    | 0  | 39        | 49 | 13        | 54 | 361    | 0 | 22        | 27 | 13        | 46 | 369    | 0  | 4         | 31 | 13         | 43 |   |
| 346    | 0 5      | 4 2          | $1 \overline{1}$ | 1 0               | 354    | o  | 37        | 41 | 13        | 52 | 362    |   | 20        |    |           |    |        | o  | 2         | 16 | 13         | 42 | • |
| 347    | 0 5      | 2 1          | 9 1:             | 59                | 355    |    |           |    |           | 51 |        | 0 | 18        | 1  | 13        | 45 | 371    | O  | 0         | 0  | 13         | 41 |   |
| 348    | 0 5      | 0 1          | 6 1              | 3 58              | 356    | 0  | 33        | 23 | 13        | 50 | 364    | 0 | 15        | 47 | 13        | 45 | ]      | 11 |           |    | ļ          |    |   |
| 349    | 0 4      | 8 1          | 2 1              | 3 57              | 357    | 0  | 31        | 13 | 13        | 50 | 365    | 0 | 13        | 32 | 13        | 44 |        | !! |           |    | •          |    |   |
| 350    | 0 4      | 6            | 7]1.             | 3 56              | 358    | 0  | 29        | 2  | 13        | 49 | 366    | 0 | 11        | 17 | 13        | 44 |        |    |           |    |            |    |   |
| 351    | 0 4      | 4            | 2 1              | 3 55              | 359    | 0  | 26        | 51 | 13        | 48 | 367    | 0 | 9         | 2  | 13        | 43 |        | -  |           |    |            |    |   |
| 352    | 0 4      | 1 5          | 6 1              | 3 54              | 360    | 10 | 2.1       | 39 | 13        | 47 | 368    | 0 | 6         | 43 | 13        | 43 |        |    |           |    | 1          |    |   |

TABLE XLI.

Of the mean motion of Mars, for days.

| Days. | •   | Mea | n mo | tion. |            | Days.   | 1  | Mea | n mo | tion. |            |
|-------|-----|-----|------|-------|------------|---------|----|-----|------|-------|------------|
|       | S.  | •   | ,    |       | 4          |         | 5. | •   | ,    | •     | •          |
| 1     | 0   | 0   | 31   | 26    | 28         | 1000    | 5  | 14  | 1    | 9     | 46         |
| 2     | 0   | 0   | 2    | 52    | 56         | 2000    | 10 | 28  | 2    | 19    | 32         |
| 3     | 0   | 1   | 34   | 19    | 25         | 3000    | 4  | 12  | 3    | 29    | 17         |
| 4     | 0   | 2   | 5    | 45    | 53         | 4000    | 9  | 25  | 4    | 39    | 3          |
| 5     | 0   | 2   | 37   | 12    | 21         | 5000    | 3  | 10  | 5    | 48    | <b>1</b> 9 |
| 6     | 0   | 3   | 8    | 38    | 49         | 6000    | 8  | 24  | 6    | 58    | 35         |
| 7     | 0   | 3   | 40   | 5     | 17         | 7000    | 2  | 8   | 8    | 8     | 21         |
| 8     | 0   | 4   | 11   | 31    | 45         | 8000    | 7  | 22  | 9    | 18    | 7          |
| 9     | 0   | 4   | 42   | 58    | 14         | 9000    | 1  | 6   | 10   | 27    | 5 <b>2</b> |
| 10    | 0   | 5   | 14   | 24    | 42         | 10000   | 6  | 20  | 11   | 37    | 38         |
| 20    | 0   | 10  | 28   | 49    | 24         | 20000   | 1  | 10  | 23   | 15    | 16         |
| 30    | 0   | 15  | 43   | 14    | 6          | 30000   | 8  | 0   | 34   | 52    | 54         |
| 40    | lo  | 20  | 57   | 38    | 47         | 40000   | 2  | 20  | 46   | 30    | 33         |
| 50    | 0   | 26  | 12   | 3     | 29         | 50000   | 9  | 10  | 58   | 8     | 11         |
| 60    | 1   | 1   | 26   | 28    | 11         | 60000   | 4  | 1   | 9    | 45    | 49         |
| 70    | 1   | 6   | 40   | 52    | 5 <b>3</b> | 70000   | 10 | 21  | 21   | 23    | 27         |
| 80    | 1   | 11  | 55   | 17    | 35         | 80000   | 5  | 11  | 33   | 1     | 5          |
| 90    | 1   | 17  | 9    | 42    | 17         | 90000   | 0  | 1   | 44   | 38    | 44         |
| 100   | 1   | 22  | 24   | 6     | <b>5</b> 9 | 100000  | б  | 21  | 56   | 16    | 22         |
| 200   | 3   | 14  | 48   | 13    | 5 <b>7</b> | 200000  | 1  | 13  | 52   | 32    | 43         |
| 300   | 5   | 7   | 12   | 20    | 56         | 300000  | 8  | 5   | 48   | 49    | 5          |
| 400   | 6   | 29  | 36   | 27    | 54         | 400000  | 2  | 27  | 45   | 5     | 27         |
| 500   | 8   | 22  | 0    | 34    | 53         | 500000  | 9  | 19  | 41   | 21    | 49         |
| 600   | 10  | 14  | 21   | 41    | 51         | 600000  | 4  | 11  | 37   | 38    | 10         |
| 700   | 0   | 6   | 48   | 48    | 50         | 700000  | 11 | 3   | 33   | 54    | 32         |
| 800   | 1   | 29  | 12   | 55    | 49         | 800000  | 5  | 25  | 30   | 10    | 54         |
| 900   | 3   | 21  | 37   | 2     | 47         | 900000  | 0  | 17  | 26   | 27    | 16         |
| 1000  | 1 5 | 14  | 1    | 9     | 46         | 1000000 | 7  | 9   | 22   | 43    | 27         |

Druva 9' 29' 35' 28'.

Epoch for all the Tables A. Cali yug 4399 complete.

♂ II. MANGALA P'HALA.

| 1   |                        |     |             |      | Sup. A | lean        | Anom  | aly. |       |          |     |    |
|-----|------------------------|-----|-------------|------|--------|-------------|-------|------|-------|----------|-----|----|
| •   | ′                      | 1+1 | Os —        | VI   | + 1    | s           | VIIs  | +11  | VIIIs | •        | ,   |    |
| -   |                        | 8   | •           | •    | s      | •           | ,     | 8    | ۰     | ,        |     |    |
| 0   | ol                     | 0   | 0           | 0    | 5      | 51          | 32    | 10   | 1     | 57       | 30  | 0  |
| 1 3 | 45                     | 0   | 46          | 45   | 6      | 29          | 48    | 10   | 22    | 45       | 26  | 15 |
| 7   | 30                     | 1   | 33          | 3    | 7      | 6           | 19    | 10   | 40    | 57       | 22  | 30 |
| 11  | 15                     | 2   | 18          | 42   | 7      | 40          | 59    | 10   | 56    | 24       | 18  | 45 |
| 15  | $\mathbf{c}^{\dagger}$ | 3   | 3           | 30   | 8      | 13          | 43    | 11   | 9     | 4        | 15  | o  |
| 18  | 45                     | 3   | 47          | 15   | 8      | 44          | 20    | 11   | 19    | 3        | 111 | 15 |
| 22  | 30                     | 4   | 29          | 58   | 9      | 12          | 40    | 11   | 26    | 21       | 7   | 30 |
| 26  | 15                     | 5   | 11          | 27   | 9      | 38          | 32    | 11   | 30    | 41       | 3   | 45 |
| 30  | O                      | 5   | 51          | 32   | 10     | 1           | 57    | 11   | 82    | 3        | υ   | o  |
|     | 1                      | 3   | <b>ΚΙ</b> ∗ | - V* | 2      | <b>(*</b> + | IVs   | _12  | ζs +  | IIIs     | •   | •  |
|     |                        |     |             | S    | up. M  | ean .       | Anoma | ıly. |       | <u>.</u> |     | -  |

The Argument of this Table is found by subtracting Mars' corrected mean place from that of his Apsis.

#### ----

TABLE of MARS' ANNUAL EQUATION, and CHILA CARNA. (\*). The Argument of this Table is found by subtracting Mars' mean place corrected, from the Sun's mean place.

3 III.

|          | _        |                                 |    |      |                 |            |    |                |              |                                 |    | C            | omm                  | ıtat   | ion.           |     |           |      |                |                |      |      | ,    |     |      |     |            |
|----------|----------|---------------------------------|----|------|-----------------|------------|----|----------------|--------------|---------------------------------|----|--------------|----------------------|--------|----------------|-----|-----------|------|----------------|----------------|------|------|------|-----|------|-----|------------|
|          |          | 1                               | +  | - Os |                 | + Is + II• |    |                |              |                                 |    |              | 9                    | + IIIs |                |     |           |      | + IVs          |                |      |      | + Vs |     |      |     |            |
| •        |          | Equation. Chila Equation. Chila |    | Eq   | Equation. Chila |            |    |                |              | Equation. Chila                 |    | Equation. Ch |                      |        | Chila<br>carna | Eq  | Equation. |      | Chila<br>carna |                |      |      |      |     |      |     |            |
|          |          | •                               | •  | •    | ,               | •          | •  | "              | -            | -                               | ,_ | 7            | ,                    |        | ,              | *   | ,         | 1    | ,              | #              | ,    | -    | 1    | -   | ,    | -   |            |
| 0        | 0        |                                 |    |      |                 |            |    |                |              |                                 |    |              | 1937                 |        |                |     |           |      |                |                |      |      |      |     | 1874 | 30  | 0          |
| 3        | 45       | 1                               |    |      |                 |            |    |                |              |                                 |    |              | 4846                 |        |                |     |           |      |                |                |      |      |      | 1   | 1743 |     | 1.5        |
| 7        | 30       | 1 .                             |    | - 1  |                 |            |    |                |              |                                 |    |              | 4751                 | 1 .    |                | - 1 |           |      |                |                | ,    |      |      | - 1 | 1618 |     | <b>3</b> 0 |
| 11<br>15 | 15       |                                 | 26 |      | 5651<br>5629    |            |    |                |              |                                 |    |              | 4651<br>4 <b>547</b> |        |                |     |           |      |                |                |      |      |      |     | 1503 | 18  | 45         |
| 18       | 45       | 1                               |    |      |                 |            |    |                |              |                                 |    |              | 4429                 |        |                |     |           |      |                |                |      |      |      |     | 1317 |     | 0          |
| 22       |          |                                 |    |      |                 |            |    |                |              |                                 |    |              | 1327                 |        |                |     |           |      |                |                |      |      |      |     | 1957 | 11  | 15<br>30   |
| ુ6       | 15       | 10                              | 16 | 45   | 5528            | 21         | 35 | 5              | 5023         | 31                              | 41 | 54           | 1210                 | 39     | 1              | 41  | 3162      | 38   | 0              | 7              | 2011 |      | 58   |     | 1209 |     | 45         |
| 30       |          |                                 |    |      |                 |            |    |                |              |                                 |    |              | <b>40</b> 90         |        |                |     |           |      |                |                | 1874 | 0    | 0    |     | 1194 | 1 9 | 0          |
| •        | <u> </u> | Equation. Chila Equation. Chila |    |      |                 |            |    | Chila<br>carna | Eq           | Equation. Chila Equation. Chila |    |              |                      |        |                |     | Eq        | uati | on.            | Chila<br>carna | Eq   | uati | •    | ,   |      |     |            |
|          |          | _ X[s _ Xs _                    |    |      |                 |            |    |                | -1Xs - VIIIs |                                 |    |              |                      |        | - VIIs         |     |           |      |                | - VIs          |      |      |      |     |      |     |            |
|          |          |                                 |    |      |                 |            |    |                |              |                                 |    | C            | ommu                 | tati   | on.            |     |           |      |                |                |      |      |      |     |      |     |            |

<sup>(\*)</sup> Chila Carna means the true distance of a Planet from the Earth, in contradistinction to its mean distance, or radius of the Deferent.

( 54 )

## TABLE XIII.

§ I.

Of the mean motion of Mercury, for days.

| Days.               |     | Mea | n moi | ion.      | -   | Days.                 |    | Mea | n mo                                         | tion.      |     |
|---------------------|-----|-----|-------|-----------|-----|-----------------------|----|-----|----------------------------------------------|------------|-----|
|                     | s.  | •   | ,     | - "       | 111 |                       | 5. | •   | <u>,                                    </u> | -          | 610 |
| 1                   | 0   | 4   | 5     | 32        | 21  | 1000                  | 4  | 12  | 19                                           | 4          | 58  |
| 2                   | 0   | 8   | 11    | 4         | 41  | 2000                  | 8  | 24  | 38                                           | 9          | 56  |
| 3                   | 0   | 12  | 16    | 37        | 2   | \$000                 | 1  | 6   | 57                                           | 1.1        | 53  |
| 4                   | 0   | 16  | 22    | 9         | 23  | 4000                  | 5  | 19  | 16                                           | 19         | 50  |
| 5                   | 0   | 20  | 27    | 41        | 43  | 5000                  | 10 | 1   | 35                                           | 24         | 48  |
| 6                   | 0   | 2-1 | 33    | 14        | 4   | 6000                  | 2  | 13  | 54                                           | 29         | 45  |
| 7                   | 0   | 28  | 38    | 46        | €5  | 7000                  | 6  | 26  | 13                                           | 34         | 43  |
| 8                   | 1   | 2   | 44    | 18        | 46  | 8000                  | 11 | 8   | 32                                           | 39         | 41  |
| 9                   | 1   | 6   | 49    | 51        | 6   | 0000                  | 3  | 2)  | 51                                           | 44         | 38  |
| 10                  | 1   | 10  | 55    | 23        | 27  | 10000                 | 8  | 3   | 10                                           | <b>4</b> 9 | 36  |
| 20                  | 2   | 21  | 50    | 46        | 54  | 20000                 | 4  | 6   | 21                                           | 39         | 12  |
| 30                  | 4   | 2   | 46    | 10        | 21  | <b>3</b> 0000         | -0 | 9   | 3 ₹                                          | 23         | 47  |
| 40                  | 5   | 13  | 41    | 33        | 48  | <b>4</b> 000 <b>0</b> | 8  | 12  | 43                                           | 18         | 23  |
| 50                  | , 6 | 21  | 36    | <b>57</b> | 15  | 50000                 | 4  | 15  | 54                                           | 7          | 59  |
| 60                  | 8   | 5   | 32    | 20        | 42  | 60000                 | 0  | 19  | 4                                            | 57         | 35  |
| 70                  | 9   | 16  | 27    | 41        | 9   | 70000                 | 8  | 22  | 15                                           | 47         | 10  |
| 80                  | 10  | 27  | 23    | 7         | 36  | <b>8</b> 000 <b>0</b> | 4  | 25  | 26                                           | 36         | 46  |
| 90                  | 0   | 8   | 18    | 31        | 3   | \$2200                | 0  | 28  | 37                                           | 23         | 22  |
| 100                 | ] 1 | 19  | 13    | 54        | 30  | 100000                | 9  | 1   | 48                                           | 15         | 58  |
| 200                 | 3   | 8   | 27    | 49        | 0   | <b>2</b> 00000        | 6  | 3   | 36                                           | 31         | €5  |
| <b>3</b> 00         | 4   | 27  | 41    | 43        | 29  | 300000                | 3  | 5   | 24                                           | 47         | 53  |
| 400                 | 6   | 15  | 55    | 37        | 59  | 400000                | 0  | 7   | 13                                           | 3          | 50  |
| <b>5</b> 0 <b>0</b> | 8   | 6   | 9     | 32        | 29  | 500000                | 9  | 9   | 1                                            | 19         | 43  |
| <b>6</b> 0 <b>0</b> | 9   | 25  | 23    | 26        | 59  | 600000                | 6  | 10  | 49                                           | 35         | 46  |
| 700                 | 11  | 14  | 37    | 21        | 23  | 700000                | 3  | 12  | 37                                           | 51         | 43  |
| 800                 | 1   | 3   | 51    | 15        | 58  | 800000                | 0  | 14  | 26                                           | 7          | 41  |
| 900                 | 2   | 23  | 5     | 10        | 28  | 900000                | 9  | 16  | 14                                           | 23         | 38  |
| 1000                | 4   | 12  | 19    | 4         | 58  | 1000000               | 6  | 18  | 2                                            | 39         | 36  |

Druva 10' 26' 48' 9".

ţ II. BHUDA P'HALA.

| 1  |                                              | <u> </u> |           | Suj        | ). mes | u A             | noma         | ly. |       |                    | ·             | 1          |
|----|----------------------------------------------|----------|-----------|------------|--------|-----------------|--------------|-----|-------|--------------------|---------------|------------|
| •  | ' ]                                          | + 0      | )3        | VIs        | + I    | · ?             | Vils.        | +11 | 37    | VIIIs              | •             | ,          |
| 0  |                                              | 0        | 0         | 0          | 2      | 18              | 23           | 3   | 53    | 53                 | 30            | 0          |
| 3  | 45                                           | 0        | 18        | 40 .       | 2      | 33              | 16           | 4   | 1     | 42                 | 52            | 15         |
| 7  | 30                                           | 0        | <b>37</b> | 6          | 2      | 47              | 21           | 4   | 8     | 52                 | 2.2           | 30         |
| 11 | 15                                           | 0        | 55        | 11         | 3      | 0               | <b>3</b> 3 ' | 4   | 14    | 17                 | 18            | 4.5        |
| 15 | O,                                           | 1        | 12        | 53         | 3      | 13              | 1            | 4   | 19    | 4                  | 15            | 'O]        |
| 18 | 4.5                                          | 1        | 30        | 7          | 3      | 21              | 39           | 4   | 23    | 45                 | 11            | <b>1</b> 5 |
| 22 | 30                                           | 1        | 46        | 47         | 3      | 35              | 20           | 4   | 25    | 29                 | 7             | -39        |
| 26 | 15                                           | 2        | 2         | 56         | 3      | 45              | 5            | 4   | 27    | 2                  | 3             | 45         |
| 30 | $-c_{\parallel}$                             | 2        | 13        | 28         | 3      | <b>5</b> 3      | 53           | 4   | 27    | 35                 | 0             | Ö          |
| -  | <u>,                                    </u> | _ ;      | [[8 -     | <b>Y</b> s | - 3    | ζs - <b>ქ</b> - | IVs          |     | X s 4 | · 111 <sup>s</sup> | •             | 7          |
| -  | <del></del>                                  |          |           | Su         | o. mea | n A             | noma!        | ly. |       |                    | - <del></del> | _          |

The Argument of this Table is found by subtracting the Sun's place corrected by vertein Equations from the place of Mercury's Apsis.

"TABLE of Mandury's Annual Equation, and Chila Carna. The Argument of this Table is found by subtracting the Sun's mean place corrected, from Mercury's mean place corrected."

ţ III.

|                                              | 1                                          | 1                            | 4                      | • • 0                                | B            | - ls                                 |                                        |                                     |                                              |                                  | <u></u> → IIs                         |                                  |                                                      |                                        | -Ullis                                   |                                  |                                                      |                            |                                      | ·IV                              | 's                                                                   |                               | 11                              |                                                                                     |                                 |             |
|----------------------------------------------|--------------------------------------------|------------------------------|------------------------|--------------------------------------|--------------|--------------------------------------|----------------------------------------|-------------------------------------|----------------------------------------------|----------------------------------|---------------------------------------|----------------------------------|------------------------------------------------------|----------------------------------------|------------------------------------------|----------------------------------|------------------------------------------------------|----------------------------|--------------------------------------|----------------------------------|----------------------------------------------------------------------|-------------------------------|---------------------------------|-------------------------------------------------------------------------------------|---------------------------------|-------------|
| •                                            | • •                                        | Eq                           | <u> </u>               |                                      | Chil         |                                      |                                        | Chila                               | Eq                                           |                                  |                                       | LChita                           | Eq                                                   |                                        |                                          | l Chila                          | Eq                                                   |                            |                                      | ICh I                            | Equ                                                                  |                               | Vs<br>Chita<br>curna            | •                                                                                   |                                 |             |
| 0<br>3<br>7<br>1<br>5<br>8<br>22<br>26<br>80 | 0<br>45<br>30<br>15<br>0<br>45<br>30<br>15 | 6                            | 1<br>1<br>1<br>0<br>58 | 42<br>15<br>30<br>26<br>4<br>1<br>27 | 1634<br>4-08 | 8<br>9<br>10<br>11<br>12<br>13<br>14 | 53<br>49<br>45<br>39<br>32<br>23<br>13 | 4<br>56<br>3<br>7<br>17<br>56<br>50 | 1507<br>1467<br>1423<br>1375<br>1324<br>4270 | 15<br>16<br>17<br>17<br>18<br>19 | 49<br>33<br>16<br>56<br>33<br>8<br>40 | 55<br>19<br>12<br>29<br>24<br>50 | 4153<br>4020<br>4025<br>3957<br>3886<br>3813<br>3735 | 20<br>21<br>21<br>21<br>21<br>21<br>21 | \$1<br>55<br>11<br>23<br>\$0<br>32<br>28 | 13<br>12<br>45<br>47<br>51<br>27 | 3584<br>3504<br>3423<br>3341<br>325'<br>3177<br>3095 | 21<br>20<br>19<br>18<br>17 | 0<br>35<br>3<br>21<br>31<br>23<br>25 | 23<br>25<br>15<br>28<br>28<br>28 | 3012<br>2030<br>2×51<br>2773<br>2697<br>2624<br>2554<br>2157<br>2426 | 13<br>12<br>10<br>8<br>6<br>4 | 39<br>3<br>13<br>25<br>26<br>20 | 57 2426<br>49 2370<br>31 2319<br>48 2275<br>55 2238<br>7 2206<br>46 2180<br>25 2173 | 26<br>22<br>18<br>15<br>11<br>7 | 1<br>3<br>4 |
| •                                            | •                                          | Equation. Cinla Equation XIs |                        |                                      |              |                                      |                                        | on<br>- X                           |                                              | Еq<br>—                          |                                       | on.                              |                                                      | Eq                                     |                                          | on.                              |                                                      | Eq                         |                                      | ion.                             |                                                                      | Equ                           |                                 |                                                                                     | ii                              |             |

## TABLE XLIII.

4 I.

Of Jupiter's mean motion for days.

| Days. |     | Mea | n mo | tion.     |    | Days.   |         | Mear       | mot        | ion. |            |
|-------|-----|-----|------|-----------|----|---------|---------|------------|------------|------|------------|
|       | s   | •   | ,    |           |    |         | s       | •          | ,          | ,    | 111        |
| 1     | 0   | 0   | 4    | 59        | 9  | 1000    | 2       | 2 <b>3</b> | 5          | 46   | 50         |
| 2     | 0   | 0   | 9    | 58        | 18 | 2000    | 5       | 16         | 11         | 83   | 40         |
| 3     | 0   | 0   | 14   | <b>57</b> | 26 | 3000    | 8       | 9          | 17         | 20   | 30         |
| 4     | 0   | 0   | 19   | 56        | 35 | 4000    | 11      | 2          | 23         | 7    | 20         |
| 5     | 0   | 0   | 24   | 55        | 44 | 5000    | 1       | 25         | 28         | 54   | 10         |
| 6     | 0   | 0   | .29  | 54        | 53 | 6000    | 4       | 18         | 34         | 41   | 0          |
| 7     | 0   | 0   | 34   | 54        | 2  | 7000    | 7       | 11         | 40         | 27   | 50         |
| 8     | 0   | 0   | 39   | 53        | 10 | 8000    | 10      | 4          | 46         | 14   | 40         |
| 9     | 0   | 0   | 44   | 52        | 19 | 9000    | , 0     | 27         | 52         | 1    | 29         |
| 10    | 0   | 0   | 49   | 51        | 28 | 10000   | 3       | 20         | 57         | 48   | 19         |
| 20    | 0   | 1   | 39   | 42        | 56 | 20000   | 7       | 11         | 55         | 36   | .39        |
| 30    | 0   | 2   | 29   | 34        | 21 | 30000   | 11      | 2          | <b>5</b> 3 | 24   | 58         |
| -40   | 0   | . 3 | 19   | 25        | 52 | 40000   | 2       | 23         | 51         | 13   | 18         |
| 50    | 0   | 4   | 9    | 17        | 21 | 50000   | 6       | 14         | 49         | 1    | 37         |
| 60    | ค   | 4   | 59   | 8         | 49 | 60000   | 10      | 5          | 46         | 49   | 57         |
| -70   | 0   | 5   | 49   | 0         | 17 | 70000   | <br>  1 | 26         | 44         | 38   | 16         |
| 80    | . 0 | . 6 | 38   | 51        | 45 | 80000   | 5       | 17         | 42         | 26   | 35         |
| 90    | 0   | 7   | 28   | 43        | 13 | 90000   | 9       | 8          | 40         | 14   | 55         |
| 160   | 0   | 8   | 18   | 31        | 41 | 100000  | 0       | 29         | 38         | 3    | 14         |
| 200   | 0   | 16  | 37   | 9         | 22 | 200000  | 1       | 29         | 16         | 6    | 29 🧸       |
| 300   | 0   | 24  | 55   | 41        | 3  | 300000  | 2       | 23         | 54         | 9    | 43         |
| 400   | 1   | 3   | 14   | 18        | 41 | 400000  | 3       | 28         | 32         | 12   | 57         |
| 500   | 1   | 11  | 32   | 53        | 25 | 500000  | 4       | 28         | 10         | 16   | 11         |
| 600   | 1   | 19  | 51   | 28        | 6  | 600000  | 5       | 27         | 48         | 19   | <b>2</b> 6 |
| 700   | 1   | 28  | 10   | 2         | 47 | 700000  | 6       | . 27       | 26         | 22   | 40         |
| 800   | 2   | 6   | 28   | 37        | 28 | 800000  | 7       | 27         | 4          | 25   | 54         |
| 900   | 2   | 14  | 47   | 12        | 9  | 900000  | 8       | 26         | 42         | 29   | 8          |
| 1000  | 2   | 23  | 5    | 46        | 50 | 1000000 | 9       | 26         | 20         | 32   | 23         |

Druva 10' 15' 45' 16".

24 II. GURU, or VRIHASPATI PHALA.

|    |          |     |            | :    | Sup. N | lean  | Anom  | aly. |      | ,     |    |            |
|----|----------|-----|------------|------|--------|-------|-------|------|------|-------|----|------------|
| ·  | <u>'</u> | 1+1 | )5         | VIs  | + 1    | s     | VIIs  | 1+11 | s    | VIIIs |    | ,          |
|    |          | 3   | •          | •    | S      | •     | ,     | 5    | ٠    |       |    |            |
| a  | 0        | 1 0 | 0          | 0    | 2      | 35    | 11    | 4    | 26   | 0     | 30 | 0          |
| 3  | 45       | 0   | 20         | 35   | 2      | 52    | S     | 4    | 35   | 13    | 26 | <b>1</b> 5 |
| 7  | 30       | 0   | 41         | o j  | 3      | 8     | 19    | j 4  | 43   | 18    | 22 | <b>3</b> 0 |
| 11 | 15       | 1   | 1          | 8    | 3      | 23    | 40    | 4    | 50   | 10    | 18 | 45         |
| 15 | O!       | , 1 | 20         | 57   | 3      | 38    | 4     | 4    | 55   | 49    | 15 | 0          |
| 18 | 45       | 1   | 40         | 19   | 3      | 51    | 32    | 5    | 0    | 13    | 11 | 15         |
| 22 | 30       | 1   | 59         | 10   | 4      | 4     | 5     | 5    | 3    | 27    | 7  | 30         |
| 26 | 15       | 2   | 17         | 23   | 4      | 15    | 36    | 5    | 5    | 20    | 3  | 45         |
| 30 | 0        | 2   | 3 <b>5</b> | 11   | 4      | 26    | 0     | 5    | 5    | 58    | O  | 0          |
| 1  | -        | _ > | (1: 4      | - Va | }      | Ks +  | [Vs   | _ 12 | K= + | IIIs  | •  | •          |
| -  |          |     |            | S    | ыр. М  | ean . | Anomi | aly. |      |       |    | -          |

The Argument is found by subtracting Jupiter's corrected mean place, from the place of his Apsis.

#### 

TABLE of Jupiter's Annual Equation, and Cuila Carna. The Argument of this Table is found by subtracting Jupiter's mean place corrected, from the Sun's mean place corrected.

4 III.

|        |          |     |      |          |                |    |          |             |                |    |      | C              | Comm           | utat | ion. |            |                |     |            |      |                |          |      |     |                |      |        |
|--------|----------|-----|------|----------|----------------|----|----------|-------------|----------------|----|------|----------------|----------------|------|------|------------|----------------|-----|------------|------|----------------|----------|------|-----|----------------|------|--------|
|        |          |     | 4    | - O:     |                |    | +        | . I:        |                | -  | +    | - []           | [1             |      | +    | П          | [8             |     | +          | · IV | rs ;           | <u> </u> | +    | - V |                |      |        |
| •      | '        | Eq  | uati | ion,     | Chila<br>carna | Eq | uati     | on.         | Chila<br>carns | Eq | uati | on.            | Chila<br>carna | Eq   | uati | op.        | Chila<br>carna | Eq  | uati       | on.  | Chila<br>carna | Equ      | uati | on. | Chila<br>carna |      | ,      |
|        |          | •   | ,    | •        | ,              | •  | ,        | *           | 1              | •  | 7    | -              | ,              |      | ,    | ,          | ,              | •   | ,          | ,    | <del></del>    | -        |      | -   |                |      |        |
| 0      | e e      | 0   | •    | _        | 4107           | 4  | 48       | 49          | 4040           | 8  | 55   | 14             | 3827           | 11   | 18   | 20         | 3506           | 10  | 50         | 57   | 3152           | 6        | 46   |     | 2871           |      | ,      |
| 3<br>7 | 45<br>30 | 1 1 |      |          | 4107<br>4104   |    | 23<br>56 |             | 1021           | 9  | 43   | 95             | 3791<br>3754   | 111  | 25   | 47         | 3401           | 10  | 32         | 33   | 3110           | -        | 2    | 5   | 2847           | 26   | 1.     |
| li     | 15       | li  | 50   |          | 4099           | _  | 29       | 6           | 3976           | 10 | 4    | 42             | 3716           | 11   | 31   | 44         | 3379           | 110 | 45         |      | 3070           | _        |      |     | 2825           |      | 3      |
| 15     | 0        | 2   | 26   |          | 4092           |    |          | 38          | 3951           | 10 | 23   | 54             | 3676           | ii   | 30   | 7          | 3326           | q   | 16         |      | 2995           |          | 23   | 26  | 2807<br>2793   | 18   | 4      |
| 18     | 45       | 3   |      |          | 4083           | 7  | 31       | 4           | 3922           | 10 | 41   | 4              | 3635           | 11   | 25   | 25         | 3282           | 8   |            |      | 2961           |          | 42   |     | 2793           |      |        |
| 22     | 30       |     |      |          | 4071           |    | 0        | 33          | 3892           | 10 | 55   | <b>5</b> 8     | 3593           | 11   | 17   | 15         | 3238           | 8   |            |      | 2928           |          |      | - 1 | 2771           | .,   | 1<br>3 |
| 36     | 15       |     |      |          | 4056           | 8  | 28       | <b>3</b> 9. | 3860           | 11 | 8    | 29             | 3550           | 11   | 5    | <b>5</b> 0 | 3195           | 7   |            |      | 2898           | _        |      |     | 2770           |      | 4      |
| 30<br> | 0        | 4   | 48   | 49       | 4040           | 8  | 55       | 14          | 3827           | 11 | 18   | 20             | 3506           | 10   | 50   | 57         | 3152           | 6   | <b>4</b> 6 | 59   | 2871           | 0        | 0    |     | 2769           | ,, , | 7      |
| •      | ,        | Eq  | uati | ion.     | Chila<br>carna | Eq | uati     | on.         | Chila<br>carna | Eq | uati | on.            | Chila<br>carna | Eq   | uati | on.        | Chila<br>carna | Eq  | uati       | on.  | Chila<br>cerna | Equ      | uati | on. | Chila<br>carna | •    |        |
|        | 1        |     | _    | <b>X</b> | [9             |    | _        | . X         | s              | ]  |      | IX             | (5             |      |      | VII        | Įs.            | ļ — |            | VI   | [3             |          |      | VI  | 5              |      |        |
|        |          |     |      |          |                |    |          |             |                |    |      | $\overline{c}$ | ommu           | tati | on.  |            |                |     |            |      |                |          |      |     |                |      |        |

TABLE XLIV.

9 I.

Of the mean motion of Venus, for days.

| Days. |            | Mean | n mot      | tion.      |            | Days.   |     | Mea | n mo | tion.      |    |
|-------|------------|------|------------|------------|------------|---------|-----|-----|------|------------|----|
|       | s.         | •    | ,          |            | и          |         | s.  | •   | ,    |            | *  |
| 1     | 0          | 1    | 36         | 7          | 44         | 1000    | . 5 | 12  | 8    | 47         | 1  |
| 2     | 0          | 3    | 12         | 15         | 27         | 2000    | 10  | 24  | 17,  | 34         | 3  |
| 3     | . 0        | 4    | 48         | 23         | 11         | 3000    | 4   | 6   | 26   | 21         | 4  |
| 4     | 0          | 6    | 21         | 30         | 51         | 4000    | 9   | 18  | 35   | 8          | 5  |
| 5     | 0          | 8    | 0          | 38         | 3 <b>8</b> | 5000    | . 3 | 0   | 43   | 55         | 7  |
| 6     | 0          | 9    | 36         | 46         | 22         | 6000    | 8   | 12  | 52   | 42         | 8  |
| 7     | ; 0        | 11   | 12         | 54         | 5          | 7000    | . 1 | 25  | 1    | 29         | 9  |
| 8     | 0          | 12   | 49         | 1          | 49         | 8000    | 7   | 7   | 10   | 16         | 11 |
| 9     | 0          | 11   | 25         | 9          | 33         | 9000    | 0   | 19  | 19   | 3          | 12 |
| 10    | , O        | 16   | 1          | 17         | 16         | 10000   | , 6 | 1   | 27   | 50         | 14 |
| 20    | 1          | 2    | 2          | 34         | 32         | 20000   | 0   | 2   | 55   | 40         | 27 |
| 30    | - 1        | 18   | 3          | 51         | 49         | 30000   | 6   | 4   | 23   | 30         | 41 |
| 40    | 2          | 4    | 5          | 9          | 5.         | 40000   | 0   | 5   | 51   | 20         | 54 |
| 50    | 2          | 20   | σ          | 25         | 21         | 50000   | 6   | 7   | 19   | 11         | 8  |
| 60    | 3          | 6    | 7          | 43         | 3 <b>7</b> | 60000   | 0   | 8   | 47   | 1          | 21 |
| 70    | <b>'</b> 3 | 22   | 9          | 0          | 53         | 70000   | 6   | 10  | 14   | 51         | 35 |
| 80    | 4          | 8    | 10         | 18         | 10         | 80000   | 0   | 11  | 42   | 41         | 38 |
| 90    | 4          | 24   | 11         | 35         | 26         | 90000   | 6   | 13  | 10   | 32         | 2  |
| 100   | 5          | 10   | 12         | 52         | 42         | 100000  | 0.  | 14  | 38   | 22         | 16 |
| 200   | 10         | 20   | 25         | 45         | 24         | 200000  | 0   | 29  | 16   | 44         | 31 |
| 300   | 4          | 0    | 38         | 38         | 6          | 300000  | 1   | 13  | 55   | 6          | 47 |
| 400   | 9          | 10   | 51         | <b>3</b> 0 | 49         | 400000  | 1   | 28  | 33   | 29         | 2  |
| 500   | 2          | 21   | 4          | 23         | 31         | 500000  | 2   | 13  | 11   | 51         | 18 |
| 600   | 8          | 1    | 17         | 16         | 13         | 600000  | 2   | 27  | 50   | 13         | 34 |
| 700   | 1          | 11   | <b>3</b> 0 | 8          | <b>55</b>  | 700000  | 3   | 12  | 28   | <b>3</b> 5 | 49 |
| 800   | 6          | 21   | 43         | 1          | 37         | 800000  | 3   | 27  | 6    | 58         | 5  |
| 900   | 0          | 1    | 55         | 54         | 19         | 900000  | 4   | 11  | 45   | 20         | 20 |
| 1000  | 5          | 12.  | 8          | 47         | 1          | 1000000 | 4.  | 26  | 83   | 42         | 36 |

Druya 8' 22' 20' 19'.

9 II. SUCRA PHALA.

| <u> </u> |    |     |           |            | Arg | gume | nt. * |             |            |        |    |    |
|----------|----|-----|-----------|------------|-----|------|-------|-------------|------------|--------|----|----|
| 1        | 1  | + ( | )s        | VIs        | + [ |      | VIIs  | + II        | 7          | VIII   |    | ,  |
| 0        | 0  | o   | 0         | 0          | 0   | 51   | 55    | 1           |            | 6      | 30 | ó  |
| 3        | 45 | 0   | 7         | 28         | 1   | Ø    | 45    | 1           | 35         | 5 '    | 06 | 15 |
| 7        | 30 | 0   | 14        | 48         | 1   | 6    | 14    | 1           | 5 <b>7</b> | 41     | 23 | 30 |
| 11       | 15 | 0   | 22        | 0          | 1   | 11   | 25    | 1           | 39         | 56     | 18 | 45 |
| 15       | 0  | 0   | 29        | 2          | 1   | 16   | 15    | 1           | 41         | 47     | 15 | 6  |
| 18       | 45 | 0   | 35        | 52         | 1   | 20   | 47    | 1           | 43         | 11     | 11 | 15 |
| 22       | 30 | 0   | 42        | <b>2</b> 6 | r   | 24   | 56    | 1           | 41         | 15     | 7  | 30 |
| 26       | 15 | 0   | 48        | 48         | 1   | 28   | 41    | 1           | 44         | 50     | 3  | 45 |
| 30       | O. | 0   | <b>54</b> | 55         | 1   | 32   | б     | 1           | 45         | 3      | 0  | O, |
| *        | ,  | _ 7 | (Is. 4    | · Vs       | X   | (s + | I Vs  |             | Xs.+       | · 171» | •  | 7  |
| <br> -   |    |     |           |            | Arg | gume | nt.   | <del></del> |            |        |    | -  |

\* The Argument is found by subtracting the Sun's corrected place, from the place of Venus' Apsis.

TABLE of Venus' Annual Equation, and Chila Carna. The Argument of this Table is found by subtracting the Sun's mean place corrected, from Venus' mean place corrected.

• 9 III.

|            |    |    |      |            |                |     |      |            | _              |    |      | C    | omm (          | itat       | ion. |     |                   |     |      |     |                |      |      |      |                |    |   |
|------------|----|----|------|------------|----------------|-----|------|------------|----------------|----|------|------|----------------|------------|------|-----|-------------------|-----|------|-----|----------------|------|------|------|----------------|----|---|
|            |    | Ī  | +    | - 0        | 5              |     | +    | · I:       | 3              |    | +    | - II | [s             | <br>       | +    | 11  | [•                | 1   | +    | 17  | 's             | <br> | -+   | - V  | 5              |    |   |
| •          |    | Eq | uati | σn.        | Chila<br>carna | Eq  | uati | on.        | Chila<br>carna | Eq | anti | on.  | Chila<br>carna | Eq         | uati | on. | Chila<br>carna    | Eq  | úati | on. | Cbila<br>carna | Eq   | uati | on.  | Chila<br>carna |    | , |
|            | -  | -  | ,    | <u>.</u>   |                | •   |      | •          | -              | •  | ,    | •    | ,              | •          | ,    | 0   | ,                 | •   | ,    | #   | ,              | •    | ,    | "    | •              |    |   |
| 0          | 0  | 0  |      | 0          | 5940           | 12  | 33   | 19         | 5734           | 24 | 43   | 32   | 5152           | 35         | 51   | 32  | 4241              | 44  | 27   | 30  | 3075           | 11   | 16   | 37   | 1786           | 30 |   |
| 3          | 45 | 1  | 34   | <b>4</b> 8 | 5936           | 14  | 6    | 13         | 5681           | 26 | 10   | 42   | 5055           | 3 <b>7</b> | 6    | 55  | 4107              | 45  | 9    | 17  | 2916           | 42   | 31   | 20   | 1630           | 26 | 1 |
| 7          | 30 | 3  | 9    | 24         | 5925           | 15  | 38   | <b>5</b> 0 | 5620           | 27 | 38   | 23   | 195            | 38         | 21.  | 4   | 3970              | 45  | 44   | 45  | 275            | 40   | 7    | 59   | 1481           | 22 | 3 |
| 11         | 15 | 4  | 44   |            | 5909           |     |      |            |                |    |      |      |                |            |      |     |                   |     |      |     |                |      |      |      |                |    | 4 |
| 15         | O, |    |      |            | 5886           |     |      |            |                |    |      |      |                |            |      |     |                   |     |      |     |                |      |      |      |                |    |   |
| 18         | 45 | 7  | 52   | 11         | 5857           | 20  | 14   | 13         | 5419           | 31 | 51   | 24   | 1617           | 11         | 43   | 3   | 3536              | 46  | 22   | 32  | 2269           | 26   | 17   | 20   | 1101           | 11 | 1 |
| 22         | 30 | 9  | 26   | ı          | 5822           | 21  | 44   | <b>4</b> 0 | 5331           | 33 | 12   | 47   | 4496           | 12         | 43   | 41  | 3385              | 6   | 3    | 43  | 2105           | 18   |      |      |                |    | 3 |
| <b>26</b>  | 15 | 10 | 59   | 27         | 5781           | 23  | 14   | 25         | 5244           | 34 | 33   | 7    | 1371           | 43         | 38   | 36  | 3231              | 145 | 23   | 17  | 1945           | 9    | 51   |      |                |    | 4 |
| 3 <b>0</b> | 0  | 12 | 33   | 19         | 5734           | 24  | 43   | 32         | 515%           | 35 | 51   | 32   | 4241           | 111        | 27   | 30  | <b>3</b> 075 <br> | 14  | 16   | 37  | 1786           | 0    | 0    | O    | 936            | 0  |   |
| •          | •  | Eq | uat  | ion.       | Chila<br>carna | Eq  | uati | on.        | Chila<br>carna | Eq | uati | on.  | Chila<br>carna | Eq         | uati | on. | Chila<br>carna    | Eq  | uati | on. | Chila<br>carna | Eq   | uati | on.  | Chila          | ·  | , |
|            | i  | 1  | •    | X          | [s             | ı — |      | - X        | 5              |    | _    | IX   |                |            |      | VI  | []•               | 1   |      | Vi  | [s             |      |      | . V) | [8             | i  |   |
| ~~~        |    |    |      |            |                |     |      |            |                |    |      |      | Comm           | utai       | ion. |     |                   |     |      |     |                |      |      |      |                |    |   |

(60)

# TABLE XLV.

ьI.

# Of Saturn's mean motion for days.

| Days. |    | Mea | n me | tion. | .  | Days.   |    | Mea | n mo      | tion. |     |
|-------|----|-----|------|-------|----|---------|----|-----|-----------|-------|-----|
|       | 8  | •   | •    | •     | •  |         | 8  | •   | ,         |       | •   |
| 1     | 0  | 0   | 2    | 0     | 23 | 1000    | 1  | 3   | 26        | 21    | 30  |
| 2     | 0  | 0   | 4    | 0     | 46 | 2000    | 2  | 6   | 52        | 43    | 1   |
| 3     | 0  | 0   | 6    | 1     | 9  | 3000    | 3  | 10  | 19        | 4     | 31  |
| 4     | 0  | 0   | 8    | 1     | 32 | 4000    | 4  | 13  | 45        | 26    | 2   |
| 5     | 0  | 0   | 10   | 1     | 54 | 5000    | 5  | 17  | 11        | 47    | 32  |
| 6     | 0  | 0   | 12   | 2     | 17 | 6000    | 6  | 20  | 38        | 9     | 3   |
| 7.    | 0  | 0   | 14   | 2     | 40 | 7000    | 7  | 21  | 4         | 30    | 33  |
| 8     | 0  | 0   | 16   | 3     | 13 | 8000    | 8  | 27  | 30        | 52    | 4   |
| 9     | 0  | 0   | 18   | 3     | 26 | 9000    | 10 | 0   | 57        | 13    | 34  |
| 10    | 0  | 0   | 20   | 3     | 49 | 10000   | 11 | 4   | 23        | 35    | 5   |
| 20    | 0  | 0   | 40   | 7     | 38 | 20000   | 10 | 8   | 47        | 10    | 1.0 |
| 30    | 0  | 1   | 0    | 11    | 27 | 30000   | 9  | 13  | 10        | 45    | 15  |
| 40    | 0  | 1   | 20   | 15    | 16 | 40000   | 8  | 17  | 34        | 20    | 20  |
| 50*   | 0  | 1   | 40   | 19    | 5  | 50000   | 7  | 21  | 57        | 55    | 25  |
| 60    | 0  | 2   | 0    | 22    | 53 | 60000   | 6  | 26  | 21        | 30    | 30  |
| 70    | 0  | 2   | 20   | 26    | 42 | 70000   | 6  | 0   | 45        | 5     | 35  |
| 80    | jo | 2   | 40   | 30    | 31 | 80000   | 5  | 5   | 8         | 40    | 40  |
| 90    | 0  | 3   | 0    | 24    | 20 | 90000   | 4  | 9   | 32        | 15    | 44  |
| 100   | 0  | 3   | 20   | 38    | 9  | 100000  | 3  | 13  | 55        | 50    | 49  |
| 200   | 0  | 6   | 41   | 16    | 18 | 200000  | 6  | 27  | 51        | 41.   | 39  |
| 300   | 0  | 10  | 1    | 54    | 27 | 300000  | 10 | 11  | 47        | 32    | 28  |
| 400   | 0  | 13  | 22   | 32    | 36 | 400000  | 1  | 25  | 43        | 23    | 18  |
| 500   | 0  | 16  | 43   | 10    | 45 | 500000  | 5  | 9   | <b>39</b> | 14    | 7   |
| 600   | 0  | 20  | 3    | 48    | 54 | 600000  | 8  | 23  | 35        | 4     | 56  |
| 700   | 0  | 23  | 24   | 27    | 3  | 700000  | 0  | 7   | 30        | 55    | 46  |
| 800   | 0  | 26  | 45   | 5     | 12 | 800000  | 3  | 21  | 26        | 46    | 35  |
| 900.  | 1  | 0   | 5    | 43    | 21 | 900000  | 7  | 5   | 22        | 37    | 25  |
| 1000  | 1  | 3   | 26   | 21    | 30 | 1000000 | 10 | 19  | 18        | 28    | 14  |

Drava. 2' 28' 53' 32',

ь II. SANI PHALA.

|     |    |     |            | 5    | Sup. M | lean     | Anom | aly. |       |        |    |            |
|-----|----|-----|------------|------|--------|----------|------|------|-------|--------|----|------------|
| ·   | ′  | + ( | )5         | VIs  | + I    | s        | VIIs | + II | s     | VIIIs  |    | •          |
| _   |    | 5   | •          |      | 8      | •        | ,    | s    | •     | ,      |    |            |
| 0   | o  | 0   | 0          | 0    | 3      | 51       | 37   | 6    | 38    | 56     | 30 | 0          |
| 3   | 45 | 0   | 30         | 35   | 4      | 17       | 10   | 6    | 52    | 53     | 26 | 15         |
| 7   | 30 | 1   | 0          | 57   | 4      | 41       | 36   | 7    | 5     | 9      | 22 | 30         |
| 111 | 15 | 1   | 30         | 57   | 5      | 4        | 46   | 7    | 15    | 31     | 18 | 45         |
| 15  | o! | 2   | 0          | 30   | 5      | 26       | 33   | 7    | 24    | 5      | 15 | 0          |
| 18  | 45 | 2   | 29         | 26   | 5      | 47       | 0    | 7    | 30    | 45     | 11 | 15         |
| 22  | 30 | 2   | 5 <b>7</b> | 35   | 6      | 5        | 56   | 7    | 35    | 38     | 7  | <b>3</b> 0 |
| 26  | 15 | 3   | 25         | 1    | 6      | 23       | 14   | 7    | 38    | 35     | 3  | 45         |
| 30  | o  | 3   | 51         | 37   | 6      | 38       | 56   | 7    | 39    | 31     | O  | 0          |
| •   | ,  |     | KIs -      | ∟ Vs |        | Xs +     | IVs  | _ I  | X - + | - IIIs | •  | )          |
|     |    |     |            |      | Sup. M | <br>Iean | Anom | aly. |       |        |    |            |

The Argument is found by subtracting Saturn's corrected mean place, from the place of his Apsis.

#### -----

TABLE of SATURN'S ANNUAL EQUATION, and CHILA CARNA. The Argument of this Table is found by subtracting Saturn's mean place corrected, from the Sun's mean place.

ь III.

|                  |            | 7   |         |          |                       |     |       |            |                |     |         | C    | ommu           | itati | on.      |     |                |     |          |      |                |    |      |      |                |      |          |
|------------------|------------|-----|---------|----------|-----------------------|-----|-------|------------|----------------|-----|---------|------|----------------|-------|----------|-----|----------------|-----|----------|------|----------------|----|------|------|----------------|------|----------|
|                  |            |     | +       | - Os     |                       |     | +     | Is         | ·              |     | +       | · II | ¥              |       | +        | Ш   | [s             |     | +        | IV   | s              |    | +    | - V  | 5              |      |          |
| ٠                | •          | Eq  | uati    | on.      | Chila<br>carna        | Eq  | uatio | on,        | Chila<br>carna | Eq  | uati    | on.  | Chila<br>carna | Eq    | uati     | on. | Chila<br>carna | Eq  | uati     | on.  | Chila<br>carna | Eq | uati | on.  | Chila<br>carna |      | ,        |
| <br>             | _          | •   | ,       |          | ,                     | •   | •     | #          |                | •   | ,       | R    | ,              | •     | •        | #   | ,              | •   | •        | *    | ,              | •  | •    | _    | ,              |      |          |
| 0                | 0          | 0   | 0       | 0        | 3811                  | 2   | 52    |            | 3769           | -   | 11      | 35   | 3 <b>64</b> 3  | 6     | 20       | 21  | 3459           | 5   | 47       | 52   | 3265           | 3  | 28   | 2    | 3117           | 30   | 0        |
| 3                | <b>4</b> 5 | 0   | 22      | _        | 3810                  |     | 12    |            | 3758           | -   |         |      | 3623           |       |          |     | 3434           |     |          |      | 3242           | 1  |      |      | 3104           |      | 15       |
| 7                | 30         | 0   | 44      | -        | 3809                  | _   | _     |            | 3745           |     |         |      | 3601           |       |          |     | 3 109          |     | 22       | _    | 3221           | ,  |      |      | i I            | 1 ~~ | 30       |
| 11               | 15         | 1   | 6<br>27 | -        | 3 <b>8</b> 06<br>3801 | , - |       |            | 3731<br>3716   | _   |         |      | 3579<br>3556   |       | 21       |     | 3384           | 1 - | -        |      | 3200           |    |      |      | 3083           |      | 45       |
| 1 <b>5</b><br>18 | 45         | _   |         |          | 3795                  |     |       |            | 3699           | 1 - | 57<br>5 |      | 3534           |       | 17<br>13 |     | 3359<br>3335   | 1   | 50<br>31 |      | 3181<br> 3162  |    |      |      | 3077<br>3072   |      | 0        |
| 22               | 30         | _   | 10      |          | 3788                  | 1 - |       |            | 3682           | -   |         |      | 3509           |       |          |     | 3313           | •   |          |      | 3146           |    |      |      | 3068           |      | 15<br>30 |
| 26               | 15         | . ~ |         |          | 3779                  | • - |       |            | 3663           | , - |         |      | 3484           |       | 58       |     | 3289           | r   |          |      | 3131           | -  |      |      | 3066           |      | 45       |
| 30               | 0          | 2   | 52      | 2        | 3769                  | 5   | 11    | <b>3</b> 5 | 3643           |     |         |      | 3459           |       |          |     | 3265           | 4   | 28       |      | 3117           |    |      |      | 3065           | , ,  | 0        |
| -                | •          | Eq  | uati    | on.      | Chila                 | Eq  | uati  | on.        | Chila<br>carna | Eq  | uati    | on.  | Chila<br>carna | Eq    | uati     | on. | Chila<br>carna | Eq  | uati     | ion. | Chila<br>carna | Eq | uati | ion. | Chila<br>carna | •    | ,        |
|                  |            | (   |         | <b>X</b> | [s                    | 1   |       | - X        |                |     | _       | . 12 | ₹s             |       |          | VI  | [[s            | -   |          | VI   | [s             |    |      | - V  | [s             |      |          |
|                  | •          |     |         |          |                       | ,   |       |            |                |     |         | (    | Commi          | tat   | ion.     |     |                |     |          |      |                |    |      |      |                |      |          |

#### TABLE XLVI.

Shewing the Lagna, Chara Cumda, and Ullagna for every Sign of the Ecliptic; calculated for the Latitude of 16° 15'; being that of Banda, near Masulipatam; to which the Commentary refers.

|             | -1:         | and IV Quad | rants.      | + 11       | and III Quad | lrants,    |
|-------------|-------------|-------------|-------------|------------|--------------|------------|
|             | Is or XIIs. | Ils or XIs. | IIIs or Xs. | IVs or Xs. | Vs or VIIIs  | VI or VIIs |
| Lagua       | 1670′       | 1795'       | 1935′       | 1935'      | 1795′        | 1670′      |
| Chara Cumda | 208         | 169         | 70          | 70         | 169          | 203        |
| Ullagna     | 1462        | 1626        | 1865        | 2005       | 1964         | 1878       |

For the Sun's Declination, Right Ascension, and Amplitude, when his Longitude is I, II, and III Signs. See Text, page 97, 98, 101, and 102.

# TABLE XLVII. (\*)

Being the 4th of the Vakiam process.

For reducing the Moon's place as computed for the time of Sun rising at Lanca, to what it is at a similar instant at another place, stated to be Trivalore near Tanjore, the Longitude of which is 3° 43′ 45′ East of Lanca, and Latitude 10° 41′ N. Communicated by Sami Nada Sashia of Pondicherry.

|                | lindu names<br>Solar months. | Tamul<br>names of | tara ca-<br>las. | Andra vical<br>las for any<br>day in the<br>same month |
|----------------|------------------------------|-------------------|------------------|--------------------------------------------------------|
| r              | <b>V</b> aisách <b>a</b>     | Chaitram          | 15'              | <b>—</b> 12"                                           |
| В<br>П         | Jyaish'ta                    | Vyassei           | 10               | 10                                                     |
| П              | A'shád'ha                    | Auni              | 7                | _ 6                                                    |
| $^{8}_{\odot}$ | Srávana                      | Audi              | 8                | + 2                                                    |
| B              | Bhádrapada                   | Auvani            | 11               | + 6                                                    |
| ₩<br>          | A'swina                      | Paratasi          | 17               | + 12                                                   |
| ≏              | Cártiga                      | Arpesi            | 21               | + 8                                                    |
| η              | Márgasíras                   | Cartiga           | 28               | + 14                                                   |
| #              | Paushia                      | Margali           | 30               | 4                                                      |
| W              | Mágha                        | Tye               | 29               | 2                                                      |
| ≈              | P hálguna                    | Maussi            | 26               | 6                                                      |
| ×              | Chaitra.                     | Poongoni          | 21               | 10                                                     |

The Desentara calas are always additive; and are to be taken for the month which precedes that for which the computation is made.

The andra vicalas are for any day in the month the computation is made for. They are to be used as multiples of the odd degrees, minutes and seconds of the Sun's true place or Sputa Graha, at Sun rising on the given day; the product of the degrees giving vicalas or seconds; that of the minutes, tarparies or thirds, and so forth.

This latter Equation is to be applied + to the Moon's uncorrected place, as indicated in the Table.

#### EXAMPLE.

| Let the Sun's Sputa Graha or true place in the Hindu Zodiuc on the 24th Audi complete (or 25th at Sun rising) be                                                                                            | s.<br>3 | •<br>2 <b>2</b> | ,<br>59 | 3       |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------|-----------------|---------|---------|
| And the D's uncorrected place at the same instant  10 Desentara calas for the month Auni  20 The andra vicalas (col. 3) for any day in Audi are + 2. The  add degrees of the Sun's Longitude are  22 59' 3" | 4       |                 |         | 13<br>0 |
| therefore $- \times \frac{2}{45^{\circ} 58^{\circ\prime\prime}}$                                                                                                                                            | or      | 5 <b>8</b> y    | +       | 46      |
| D's place corrected for Desentara, 24th Audi                                                                                                                                                                | 4       | 4               | 4       | 59      |

There only remains the Equation of the Arca Bhagábala to be applied to the Moon's corrected place, to have her Sputa Graha or true place, at Sun rise on the 25th Audi, at the place computed for. N. B.—The common Kalendar makers use indiscriminately the above Table for any place in these South Eastern Provinces.

#### TABLE XLVIII.

For the Solar Ahargana from the beginning of the Cali yug, the mean Solar Sydereal year. being 1577917928 or 365d 15g 31v 31p 24s.

|          |                       |          |        | F        | `irst   | Part, a      | ccording t                | o the   | S             | urri:        | ah Siddhanta.                                                          |                           |               |            |            |        |          |
|----------|-----------------------|----------|--------|----------|---------|--------------|---------------------------|---------|---------------|--------------|------------------------------------------------------------------------|---------------------------|---------------|------------|------------|--------|----------|
| Years.   | <del></del>           | ing      |        |          |         | Years.       | Time due                  |         |               |              | Names of Solar<br>months accord-<br>ing to the Sur-<br>rizh Siddharta. | 9                         | Tim           |            | ue t       |        | ach      |
| 1        | <b>3</b> 65           | G.       | V.     |          | S.      | 100          | D.                        | G.      | V.            |              | Surriah Sid                                                            | dha                       |               |            |            | -      |          |
| 2        | 730                   |          | 3      | 2        | 48      | 200          | 365 <b>25</b><br>73051    |         | 32<br>4       | 40           | Mésha masa                                                             | 1                         | D. 20         | 6.<br>55   |            | P.     | s.<br>39 |
| 3        | 1095                  |          |        | 34       |         | 300          | 109577                    |         |               | 0            | Vijsha m.                                                              | γ<br>8                    | 1             | 24         |            |        | 41       |
| -1       | 1461                  | 2        | 6      | 5        | 36      | 400          | 1 16103                   |         | 9             | 20           | Mid'huna m.                                                            | П                         | 1             | 36         |            |        | 4.1      |
| 5        | 1826                  | 17       | 37     | 37       | 0       | 500          | 182629                    |         |               |              | Carcáta m.                                                             | 5                         | 1 ~-          | 28         |            |        | 42       |
| 6        | 2191                  | 33       | 9      | 8        | 24      | 600          | 219155                    | 15      | 14            | 0            | Tinha m.                                                               | 3                         | 31            |            | 10         |        | 40       |
| 7        | 2556                  | 48       | 40     | 39       | 48      | 700          | 255681                    | 7       | 46            | 20           | Canyà m.                                                               | m                         | ;             | 27         |            | 2      |          |
| 8        | 2922                  | 4        | 12     | 11       | 12      | 800          | 292207                    | 0       | 13            | <b>4</b> 0   | Tulà m.                                                                | 12                        | 29            | 5 <b>4</b> | 7          | 2      |          |
| 9        | 3 <b>2</b> 87         |          |        |          | 36      | 900          | 328732                    | 52      | 51            | 0            | Vrischica m.                                                           | lπ                        |               | 30         | 24         | 2      | 33       |
| 10       | 3652                  |          |        |          | 0       | 1000         | 365258                    |         |               | <b>2</b> 0   | Dhanus m.                                                              | 1                         | 29            | 20         | 53         | 2      | 31       |
| 20       | 7305                  |          |        |          | 0       | 2000         | 730517                    |         |               | 40           | Macara m.                                                              | M                         | 29            | 27         | 16         | 2      | 32       |
| 30       | 10957                 |          |        |          | O,      | 3000         | 1095776                   |         |               | 0            | Cumbha m.                                                              | <b>*</b>                  | 29            | 48         | 24         | 2      | 33       |
| 40       | 14610                 |          |        | 56       | 0       | 4000         | 1461035                   | _       |               | 20           | Min m.                                                                 | 7                         |               | 20         |            |        | 36       |
| 50       | 118262                |          |        |          | 0       | 5000         | 1826293                   |         |               | - 1          | Kalendar names                                                         |                           |               | ely)       | End        | of c   | ach      |
| 60       | 21915                 |          |        |          | 0       | 1            | 2191552                   |         |               | 0            | Vaisácha                                                               | ıπ                        | anth.<br>  30 | 55         | 39         | 2      | 39       |
| 70<br>80 | 25568                 |          |        | 38       | 0       | i            | 2556811                   |         |               | 20           | Jyaishta                                                               | l                         | l .           | 19         |            | 5      |          |
| 80<br>90 | 29230                 |          | 1      | 52       | 0       | 8000         | 2922070                   | 3       |               | 40!          | Ashar                                                                  | й                         | Ŧ.            | 56         |            | Š      | 4        |
| 100      | 32873                 |          |        | 6<br>20  | 0       | 9000         | 3287328                   |         | 30            | _0;          | Srávana                                                                | -                         | 125           |            |            | 10     |          |
|          | 365 <b>2</b> 5        | 52       | 32<br> | 20       | Ol      | 110000       | 3652587                   |         | <del>55</del> | 20           | Bhadrapada                                                             | Ω                         | 153           |            |            | 13     |          |
| _        |                       |          |        |          |         |              |                           |         |               |              | A'swina                                                                | m                         | 186           |            | 6          | 16     | 4        |
| For the  | Solar .               | Aha      | rga    | na       | from    | m the b      | eginning .                | of th   | he (          | Calı         | Cartiga                                                                | 2                         | 216           |            | 13         | 18     | 39       |
| 2/7/0    | the me                | an (     | Sola   | r S      | ו אוני  | real nea     | r being 1                 | 5 7 7 9 | 1.75          | <u>00</u> ,  | Margasiras                                                             | m                         | 246           | 18         | 37         | 21     | 12       |
|          |                       |          |        |          |         | · 9 ·        | , oceang -                | ¥ 3 2   | 000           | ,0-          | Paushia                                                                | 1                         | 275           | 39         | 30         | 23     | 43       |
| or 35    | 5d 15g                | 31 v     | 15     | '· (*    | *)      |              |                           |         |               |              | (Màgha                                                                 | ٧۶                        | 305           | 6          | <b>4</b> 6 | 26     | 15       |
| Se       | coud P                | art.     | асс    | ord      | ing     | te the A     | ria Siddha                | ınta,   |               | l            | P'hal'guna                                                             |                           | 334           |            |            |        |          |
|          |                       |          |        |          |         |              |                           |         |               |              | Chaitra                                                                | ₩,                        | 365           | 15         | 31         | 31     | 23       |
| **       | Time o                |          |        |          | nd-     | l            | Time of c                 |         |               | nd-          |                                                                        |                           |               |            |            |        |          |
| Years.   | ing                   | z pe     | riod   | ls.      |         | Years.       | ing p                     | Priod   | ls.           | _ !          | Aria Siddi                                                             | ıan                       | ta (se        | para       | atel       | y).    | :        |
|          | D.                    | G        | . –    | ٧.       | P.      |              | D.                        | G.      |               | v.           |                                                                        | 1                         | D.            | G.         | v          |        | Р.       |
| 1        | 365                   | 15       | 5 3    | 31       | 15      | 100          | 3652 <b>5</b>             | 52      | :             | 5            | Chaitram                                                               | $\gamma^{!}$              | 30            | 55         | 3          | 2      | 1        |
| 2        | 730                   | 3        | l      | 2        | 30      | 200          | 73051                     | 44      | . 1           | 10           | Vyassei                                                                | 8                         | 31            | 24         | 1          | 2      | 1        |
| 3        | 1095                  | 46       | 3 3    | 33       | 45      | 300          | 109577                    | 36      |               | 5            | Auni                                                                   | П                         | 31            | 3 <b>6</b> | 3          | 8      | 1        |
| 4        | 1461                  | 9        |        | 5        | o       | 400          | 146103                    | 28      |               | 20           | Audi                                                                   | 95                        | 31            | 28         |            | 2      | 2        |
| 5        | 1826                  | 17       |        | 36       | 15      | 500          | 182629                    | 20      |               | 5            | Auvani                                                                 | $\Omega$                  | 31            | 2          |            | 0      | 1        |
| 6        | 2191                  | 30       |        | 7        | 30      | 600          | 219155                    | 12      |               | 10           | Paratas <b>i</b>                                                       | 呗                         | 30            | 27         |            | 2      | 1        |
| 7        | 2556                  | 48       |        | 38       | 45      | 700          | 255681                    | 4       |               | 5            | Arpesi                                                                 | -≏                        | 29            | 54         |            | 7      | 1        |
| 8        | 2992                  | 4        |        | 0        | 0       | 800          | 292206                    | 56      |               | 0            | Cartiga                                                                | m                         | 29            | 30         |            | ł      | 2        |
| 9<br>10  | 3287                  | 19       |        | H        | 15      | 900          | 328732                    | 48      |               | 5            | Margali                                                                | 1                         | 99            | 20         | 5          |        | 1        |
| 20       | 365 <b>2</b>          | 35       |        | 2        | 30      | 1000         | 365 <b>2</b> 53<br>730517 | 40      |               | 0            | Tye                                                                    | A)                        | 29<br>00      | 27         |            | 6      | 1        |
| 30       | 7305<br>109 <b>57</b> | 10       |        | 25       | 0       | 2000<br>3000 | 1095776                   | 21<br>2 |               | 0            |                                                                        | 222                       | 29            | 43         |            |        | 1        |
| 40       | 14610                 | 45<br>20 |        | 37<br>50 | 30<br>0 |              | 1461034                   | 43      |               |              | Poongoni                                                               | $\mathbf{X}_{\mathbf{r}}$ | 30            | 20         |            |        | , 2      |
| 50       | 18262                 | 50       |        | 2        | 30      |              | 1826293                   | 24      |               | ر <b>ن</b> د | (Collectively)<br>Chaitram                                             |                           |               |            |            |        |          |
|          | 21915                 | 31       |        | .5       | 0       | 6000         | 2191552                   | 5       |               | o            | I                                                                      | Y                         | 30<br>62      | 55         |            | 2<br>4 | 1        |
| 70       | 25568                 | 6        |        | 27       | 30      |              | 2556310                   | 45      |               | . 11         |                                                                        | ğ                         | 02<br>93      | 19         |            |        | 3        |
| 80       | 29920                 | 4 i      |        | 0        | 0       | 8000         | <b>2</b> 9.2 <b>2</b> 069 | 26      |               | o !          | Audi                                                                   | Ⅱ  <br>જી                 | 9.5<br>12.5   | 56<br>24   |            | 2<br>4 | 5        |
| 90       | <b>3</b> 2873         | 16       |        | 2        | 30      |              | 3287328                   | 7       |               | o            | Auvani                                                                 |                           | 156           | 26         |            | 4<br>4 | 6        |
|          | 36525                 | 52       |        | 5        | 0       |              | 3652586                   | 48      |               | ~ 11         |                                                                        |                           | 180           | 54<br>54   |            | 6      | 7        |
|          |                       |          |        |          | - 11    |              |                           |         |               | - 11         | Arpesi                                                                 |                           | 216           | 48         |            | 3      | 8        |
| (*) The  |                       |          |        |          |         |              |                           |         |               |              |                                                                        |                           | 946           | 18         |            |        | 10:      |

Tye

Maussi

Poongoni

18

55

37 10:

10 15

m 246 1 275 vs 305

**≈** 334

€ 365

11 12 46

15

<sup>(\*)</sup> The same Solar year according to the copies of the Aria Sid | Cartiga dhanta preserved in Bengal, is 1-77-91-94200 = 365p 15d 31p 17c 67 Margali this year is unknown in the Peninsula.

#### TABLE XLIX.

For the Luni-solar Ahargana, from the beginning of the Cali yug, the mean Lunation being  $\frac{4577017823}{5343332}$  or 29d 31g 50v 6p 59s,78.

First Part, according to the Surriah Siddhanta. (\*)

| Years. |        |      | e du<br>ding |    |       | Years.  | Tim<br>correspon |    |    |    | ds. | Luna-<br>tions. | of th | e re | spec |    | e end<br>mean |
|--------|--------|------|--------------|----|-------|---------|------------------|----|----|----|-----|-----------------|-------|------|------|----|---------------|
|        | p.     | G.   | v.           | P. | s.    |         | D.               | G. | ₹. | P. | s.  |                 | D.    | G.,  | ٧.   | P. | s.            |
| 1      | 354    | 22   | 1            | 23 | 57,14 | 100     | 35436            | 42 | 19 | 55 | 14  | 1               | 1     |      |      |    | 1             |
| 2      | 708    | -1-1 | 2            | 47 | 51,28 |         | 70873            |    |    |    |     | 1               |       |      |      |    | 59,78         |
| 3      | 1063   |      |              |    | 51,12 |         | 106310           |    |    |    | 42  | 2               |       |      |      |    | 59,56         |
| 4      | 1      |      |              |    | 48,56 |         | 141746           |    |    |    | 1   | 1               |       |      |      |    | 59,34         |
| 5      | 1771   |      |              |    | 45,70 |         | 177183           |    |    |    |     |                 |       |      |      |    | 59,12         |
| 6      | 2126   |      |              |    | 42,84 | 1 [     | 212620           |    |    |    | 1   |                 |       |      |      |    | 58,90         |
| 7      | 1      |      |              |    | 39,98 | 1 1     | 248056           |    |    |    | 1   | 1 -             |       |      |      |    | 58,68         |
| 8      | •      |      |              |    | 37,19 |         | 283493           |    |    |    | 52  | 1               |       |      |      |    | 58,46         |
| 9      |        |      |              |    | 34,25 |         | 318930           |    |    |    | - 6 |                 |       |      |      |    | 58,24         |
| 10     | t .    |      |              |    | 31,40 |         | 354367           |    | _  |    | ,   |                 | 265   |      |      |    | 58,01         |
| 20     | 7037   | 20   | 27           | 59 | 2,8   | 2000    | 708734           |    |    |    | 40  | 10              | 1     |      |      |    | 57,80         |
| 30     | 10631  |      |              |    |       | 3000    | 1063101          |    | 57 |    |     |                 |       |      |      |    | 57,56         |
| 4)     | 14174  |      |              |    |       | 4000    | 1417468          |    |    |    |     |                 |       |      |      |    | 57,36         |
| 50     | 17718  |      |              |    |       | 5000    | 1771835          |    |    |    |     | i i             | 383   | 53   | 51   | 30 | 57,14         |
| 60     |        |      |              |    | 8,4   | 6000    | 2126202          |    |    |    |     | ļ               | 1     |      |      |    |               |
| 70     |        |      |              |    | 39,8  |         | 2430569          |    |    |    |     |                 | 1     |      |      |    |               |
| 80     | 28349  | 21   | 51           | 56 | 11,2  | 8000    | 2834936          |    |    |    |     | 1               | l     |      |      |    |               |
| 90     |        |      |              |    | 42,6  | 9000    | 3189303          |    |    |    |     | 1               | 1     |      |      |    |               |
| 100    | 135436 | 42   | 19           | 55 | 11,0  | 1110000 | 35 13670         | 33 | 12 | 3  | 20  | 1               | į     |      |      |    |               |

For the Luni-solar Akargana from the beginning of the Califyug, the mean Lunation being  $\frac{15.77.1175.00}{344.33340}$  or 29d 31g. 50v 5p 40s, 21, &c.

Second Part, according to the Aria Siddhanta.

| Years. |        | l'ime<br>pond |    |     |      | Years. | Tim<br>correspon |            |    |    | ds. | Luna-<br>tions. | of th | e re |    | tive | e end<br>mean<br>hs. |
|--------|--------|---------------|----|-----|------|--------|------------------|------------|----|----|-----|-----------------|-------|------|----|------|----------------------|
|        | D.     | G.            | ٧. | P.  | s.   |        | D.               | G.         | T. | P. | s.  |                 | ρ.    | G.   | v. | P.   | 8.                   |
| 1      | 354    | 22            | 1  | 8   | 2,6  | 100    | 35436            | 41         | 53 | 24 | i   | ĺ               |       |      |    |      |                      |
| 2      | 703    | 44            | 2  | 16  | 5,2  | 200    | 70873            | 23         | 46 | 48 | 40  | 1               |       |      |    |      | 40,21                |
| 3      | 1063   | 6             | 3  | 24  | 7,8  | 300    | 106310           | 5          | 40 | 13 | 0   | 2               | 59    |      |    |      | 20,42                |
| 4      | 1117   | 28            | 4  | 32  | 10,4 | 400    | 141746           | 47         | 33 | 37 | 20  | 3               |       |      |    |      | 0,63                 |
| 5      | 1771   | 50            | 5  | 40  | 13,0 | 500    | 177183           | 29         | 27 | 1  | 40  | 4               |       |      |    |      | 40,84                |
| 6      | 2126   | 12            | 6  | 48  | 15,6 | 600    | 212620           | 11         | 20 | 26 | 0   | 5               |       |      |    |      | 21,06                |
| 7      | 2480   | 34            | 7  | 56  | 18,2 | 700    | 248056           | 53         | 13 | 50 | 20  | 6               | ,     |      |    |      | 1,28                 |
| 8      | 2834   | 56            | 9  | .1  | 20,8 | 800    | 283493           | 35         | 7  | 14 | 40  | 7               |       |      |    |      | 41,50                |
| 9      | 3189   | 18            | 10 | 12  | 23,4 | 900    | 318930           | 17         | 0  | 39 | O.  | 8               |       |      |    |      | 21,72                |
| 10     | 3543   | 40            | 11 | 20  | 26,0 | 1000   | 354366           | <b>5</b> 3 | 54 | 3  | 20  | 9               |       |      |    |      | 1,94                 |
| 20     | 7087   | 20            | 22 | 40  | 52,0 | 2000   | 708733           | 57         | 43 | 6  | 40  | 10              |       |      |    |      | 42,16                |
| 30     | 10631  | 0             | 34 | 1   | 18,0 | 3000   | 1063100          | 56         | 42 | 10 | O   | 11              | 324   |      |    |      | 22,38                |
| -10    | 14174  | 40            | 45 | 21  | 44,0 | 4000   | 1417-167         | 55         | 36 | 13 | 20  | 12              | 354   | 22   | 1  | 8    |                      |
| 50     | 17713  | 20            | 56 | 42  | 10,0 | 5000   | 1771834          | 54         | 30 | 16 | 40  | 13              | 383   | 53   | 51 | 13   | 42,82                |
| 60     | 21262  |               | 8  | 2   | 36,0 | 6000   | 2126201          | 53         | 24 | 20 | 0   |                 | 1     |      |    |      |                      |
| 70     | 5480   | 41            | 19 | 23  | 2,0  | 7000   | 2180563          | 52         | 18 | 23 | 20  | 1               |       |      |    |      |                      |
| SO     | 28349  | 21            | 30 | -13 | 28,0 | 8000   | 2834935          | 51         | 12 | 26 | 40  | <b>.</b>        | 1     |      |    |      |                      |
| 90     | 3189   | 31            | 42 | . 3 | 54.0 | 9000   | 3189302          | . 5G       | 6  | 30 | 0   | 11              | 1     |      |    |      |                      |
| 100    | 135436 | 3 41          | 53 | 24  | 20,0 | 10000  | 3543669          | 49         | 0  | 33 | 20  | 11              | •     |      |    |      |                      |

<sup>(\*)</sup> The Peninsula Astronomers, Tellinga as well as Tamul, invariably use in their computations the Solar Ahargana according to the Aria, and the Lunar according to the Surriah, Siddhantas.

# Use and Application of Tables XLVIII and XLIX.

#### TABLE XLVIII.

#### EXAMPLE I.

1º Wanted the Solar Ahargana for the beginning of the Solar year 4924 of the Cali yug, or 4923 complete, (A. D. 1822), according to the Surriah Siddhanta.

|                                         | Y.  |   | b.      |    | ▼. |    |
|-----------------------------------------|-----|---|---------|----|----|----|
| By Table XLVIII, part 1, we have for 46 | 000 | - | 1461035 | 1  | 33 | 20 |
|                                         |     |   | 328732  |    |    | 0  |
|                                         | 20  | - | 7305    | 10 | 30 | 28 |
|                                         | 3   | - | 1095    | 46 | 34 | 34 |
|                                         |     |   | 1798168 | 51 | 29 | 22 |
| Subtract Sodhyam, or constant Equation  |     | - | - 2     | 8  | 51 | 15 |

Ahargana, 1st Vaisácha γ, which divide by 7)1798166 (42 38 7

Remainder 6 which counted from

Friday, gives Soota dina Thursday.

2º Wanted the Ahargana for the 1st of Vrischica masa, or Bengal Margasiras, of the same year.

| Ahargana for 1st Vaisácha, al | bove found | in the last | 1798166 |    |    |    |
|-------------------------------|------------|-------------|---------|----|----|----|
| column down to Cartiga        | •          | -           | 216     | 48 | 13 | 19 |

Ahargana, 1st Margasiras my, which divide by 7)1798383 (80 51 20

Remainder 6 which counted as usual

from Friday, gives Soota dina Thursday.

#### EXAMPLE II.

1. Wanted the same, according to the Aria Siddhanta.

|    |               |         |              | Y.   |   | D.                   | C. | ₹. | P. |
|----|---------------|---------|--------------|------|---|----------------------|----|----|----|
| By | Table XLVIII, | part 2, | we have for  | 4000 | - | 1161034              | 43 | 20 | 0  |
| •  | •             | • ′     |              |      |   | 323732               |    |    | 0  |
|    |               |         |              | 20   | - | <b>7</b> 30 <b>5</b> | 10 | 25 | 0  |
|    |               |         |              | 3    | - | 1095                 | 46 | 33 | 45 |
|    |               |         |              |      |   | <b>17</b> 9\$163     | 29 | 3  | 45 |
|    |               |         | Subtract Sou | hyam | - | 2                    | 8  | 51 | 15 |
|    |               |         |              |      |   |                      |    |    |    |

Ahargane, 1st Chaitram  $\gamma$ , which divide by 7)1798166 (20) 12 33

Remainder 6 which counted from

Friday, gives Soota dina Thursday.

But here the Civil beginning by the respective accounts will differ, on account of the fraction of days, which by the Surriah Siddhanta is 422 387 7P, exceeding 30; and by the Aria Siddhanta 20g 127 30P below 30. Hence the feria of the first Civil day in the year will be, viz. by the Surriah, Friday; and by the Aria, Thursday.

20 Wanted the Ahargana for the 1st Cartiga (Tamul denomination) of the same year,

| Ahargana for 1st Chaitram, above found Add collective number of days registered in the last | 1798166  |    |     |   |  |
|---------------------------------------------------------------------------------------------|----------|----|-----|---|--|
| column down to Arpesi                                                                       |          | 48 | 13  | 8 |  |
|                                                                                             |          |    |     |   |  |
| n                                                                                           | 17000000 | _  | ~ ~ |   |  |

Same Ahargana, as by the Surriah Siddhanta • 1798383 8 25 38 subject to the same difference of Civil reckoning.

#### TABLE XLIX.

#### EXAMPLE I.

Wanted the Luni-solar Ahargana according to the Surriah Siddhanta, for the end of the 4923d year of the Cali yug. The Solar Ahargana for the beginning of the year 4924 being 17981664 425 387 7p.

|       |       | argana as               |                        |     |     |                |    |    |            |    |
|-------|-------|-------------------------|------------------------|-----|-----|----------------|----|----|------------|----|
| as an | Index | ۲.                      | By Table XLIX, part 1, | Ţ.  |     | D.             | G, | ▼. | P.         | 5. |
|       |       | D.                      | column 2, for 4        | 000 | -   | 1417468        | 13 | 16 | 49         | 20 |
| 4024  | •     | <b>1</b> 79816 <b>6</b> | ,,                     | 900 | -   | <b>3</b> 18930 | 20 | 59 | 17         | 6  |
| (1)   | _     | 1744549                 | Column 1,              | 20  | -   | 7087           | 20 | 27 | 59         | 3  |
|       |       | 53617                   | "                      | 3   | -   | 1063           | 6  | 4  | 11         | 51 |
| (2)   | •     | <b>3</b> 543 <b>6</b>   | Intercalations.        |     | (1) | 1744549        | 0  | 48 | 17         | 20 |
|       |       | 18181                   | Column 2,              | 100 | • • | 35436          | 42 | 19 | 55         | 14 |
| (3)   |       | 17718                   | Column 1,              | 50  | (3) | 17718          | 21 | 9  | 57         | 37 |
| •     |       | 469                     |                        | 1   | (4) | 354            | 22 | 1  | 23         | 57 |
| (4)   | _     | 46 <b>3</b><br>354      | 3 Lunar mo             |     |     | 88             | 35 | 30 | 2)         | 59 |
|       |       | 109                     |                        |     |     | 1798147        | [1 | 49 | 5 <b>5</b> | 7  |
| (5)   | -     | <b>\$</b> 8             |                        |     |     | + 1            |    |    |            |    |

Remainder 21 which neglect. Luni-solar Ahargana sought 1798148 and for the Soota dina, or day of conjunction 7)1798148 (256878 weeks.

Remainder 2 counted from Thursday, gives Saturday.

#### EXAMPLE II.

#### 29 The same, according to the Aria Siddhanta.

| the same<br>ceding a<br>number | e as inticle<br>of d<br>dex n | Ahargana is in the pre- e as to the lays. The night there- | By Table XLIX, part 2 column 2, for |          |       | D.<br>1417467<br>318930<br>7087<br>1063 | 55<br>17<br>20 | 0   | 13<br>39<br>40 | 20<br>0<br>52 |
|--------------------------------|-------------------------------|------------------------------------------------------------|-------------------------------------|----------|-------|-----------------------------------------|----------------|-----|----------------|---------------|
| 4924                           | -                             | 1798166                                                    |                                     |          | (1)   | 1744548                                 | 39             | 2   | 57             | 19,8          |
| (i)                            | -                             | 714548                                                     | ſ                                   | 100      | (2)   | 35436                                   | 41             | 53  |                |               |
|                                |                               | 53618                                                      | Intercalations. 🕹                   | 50       | (3)   | 17718<br>354                            | <b>2</b> 0     | 56  | 42             | 10            |
| (2)                            | _                             | <b>3</b> 543 <b>6</b>                                      | •                                   | 1        | (4)   | 354                                     | 22             | 1   | 8              | 2,6           |
| (~)                            | •                             | •                                                          | (3 Luna)                            | months   | i (5) | 88                                      | 35             | 30  | 17             | 0,6           |
| 40)                            |                               | 19182                                                      |                                     |          |       |                                         |                |     |                |               |
| (3)                            | -                             | 17718                                                      |                                     |          |       | 1798146                                 | 39             | 24  | 28             | 53,0          |
|                                |                               | 464                                                        |                                     |          |       | + 1                                     |                |     |                |               |
| (4)                            | -                             | 354                                                        |                                     |          |       | 1798147                                 |                |     |                |               |
|                                |                               | 110                                                        | <b>5</b> " ' T                      |          |       |                                         | 7.             |     | • .            | •••           |
| (5)                            | •                             | 88                                                         | Proceeding as in Ex-                | ample 1, | , Ior | the Soots                               | ı dı           | na, | it w           | ill De        |
|                                |                               | 22                                                         | found to fall on Friday             | •        |       |                                         |                |     |                |               |

N. B.—The Tamul Astronomers, though computing in Solar time, use in preference the Lunisolar Ahargana according to the Surriah Siddhanta; and for the Solar, the Aria Siddhanta.

TABLE L.

This Table shows the Root or Character of every month in the Mahommedan year, according as that of Mahorum is 1, 2, 3, 4, 5, 6, or 7. It is therefore always to be entered with the Root given in Table I.

|    | Names of the months.         | Number of days in each month. |   |   |   | Roots |     |   | - |
|----|------------------------------|-------------------------------|---|---|---|-------|-----|---|---|
| 1  | Mahorum                      | 30                            | 1 | 2 | 3 | 4     | 5   | 6 | 7 |
| 2  | Sepher, or Suffr             | 29                            | 3 | 4 | 5 | 6     | 7   | 1 | 2 |
| 3  | Rabi-el-Avul                 | 30                            | 4 | 5 | 6 | 7     | 1   | 2 | 3 |
| 4  | Rabi.el-Aukeer               | 29                            | 6 | 7 | 1 | 2     | 3   | 4 | 5 |
| 5  | Giumadi; or el-Avul          | 30                            | 7 | 1 | 2 | 3     | 4   | 5 | σ |
| 6  | Giumadi; or del-Aukeer       | 29                            | 2 | 3 | 4 | 5     | . 6 | 7 | 1 |
| 7  | Regeb; or Regihab            | 30                            | 3 | 4 | 5 | 6     | 7   | 1 | 2 |
| 8  | Shahaban                     | 29                            | 5 | 6 | 7 | 1     | 2   | 3 | 4 |
| 9  | Ramazan; or<br>Rhamadan      | 30                            | 6 | 7 | 1 | 2     | 3   | 4 | 5 |
| 10 | Shawal                       | 29                            | 1 | 2 | 3 | 4     | 5   | 6 | 7 |
| 11 | Zoolcada; or<br>Zoolcayadah  | 30                            | 2 | 3 | 4 | 5     | 6   | 7 | 1 |
| 12 | Zooledgee; or Zooleagiadah B | 29<br>or<br>30                | 4 | 5 | 6 | 7     | 1   | 2 | 3 |

N. B.—The month of Zooledgee, consists of 29 or 30 days, according as the year is a common or an intercalary one.

Table LI helps to determine what Hindu Solar year concurs at its beginning with any proposed year of the Hejira; and inversely to indicate, in what year of the Hejira any proposed Solar year happens to begin.

Thus any Hindu Solar year commencing between A. Hejirn 1 and 81 has for limits, the 18th (one day less than the 19th, registered in the 3d column of the second Section of Table LI), and the 21st (one day more than the 20th), March of its concurrent European year, Julian style.

Any Hindu Solar year falling between the 906th and 1009th year of the Hejira cannot commence earlier than the 26th (one day less than the 27th), and later than the 28th (one day more than the 27th), of March, Old style; or before the 5th and after the 7th April, New style.

TABLE LI.

Exhibiting the respective beginnings of the Hejira, and Hindu Solar, concurrent with

European Secular years.

|                 | f Hejira concurrent<br>opaan Secular years. |                        | ndu Solar y<br>th Europea         |          |                                                   |                                |
|-----------------|---------------------------------------------|------------------------|-----------------------------------|----------|---------------------------------------------------|--------------------------------|
| Anno<br>Hejiræ. | Epoch of beginning.                         | Anno<br>Cali<br>yugam. | Year of<br>Salivahana<br>or Saca. | of Hindu | Beginning<br>of Hindu<br>Solar years<br>in April. | Christian<br>Secular<br>years. |
|                 |                                             |                        | •                                 | 0. S.    | N. S.                                             |                                |
| 1               | 16 July                                     | 3794                   | 545                               | 19       | ,,                                                | • 622                          |
| 81              | 26 February                                 | 3802                   | 623                               | 20       | 99                                                | 700                            |
| 184             | 1 February                                  | 3902                   | 723                               | 20       | "                                                 | 800                            |
| 237 }<br>288 }  | 1 January<br>26 December                    | 4002                   | 823                               | 21       | "                                                 | 900                            |
| 391             | 1 December                                  | 4102                   | 923                               | 22       | ,,                                                | 1000                           |
| 494             | 6 November                                  | 4202                   | 1023                              | 23       | 22                                                | 1100                           |
| 597             | 12 October                                  | 4302                   | 1123                              | 24       | ;,                                                | 1200                           |
| 700             | 16 September                                | 4402                   | 1223                              | 25       | "                                                 | 1300                           |
| 803             | 22 August                                   | 4502                   | 1323                              | 26       | 27                                                | 1400                           |
| 906             | 28 July                                     | 4602                   | 1423                              | 27       | 6                                                 | 1500                           |
|                 | O. S. N. S.                                 |                        |                                   |          |                                                   |                                |
| 1009            | 3 July 13 July                              | 4702                   | 1523                              | 27       | 6                                                 | 1600                           |
| 1112            | 7 ,, 18 June                                | 4802                   | 1623                              | 28       | 8 ¦                                               | 1700                           |
| 1215            | 13 ,, 25 May                                | 4902                   | 1723                              | 29       | 10                                                | 1800                           |
| 1318            | 18 April 1 May                              | 5002                   | 1823                              | 50       | 12                                                | 1900                           |

### TABLE LII.

#### PART THE FIRST.

Shewing the Sun's mean Longitude on the 1st of January of each Secular year of the Julian Kalendar, from A. A. C. 4000 to A. D. 4000, constructed by means of Delalande's Solar Tables I and II (Edition of 1764) for noon time under the Meridian of Paris.

|                                      | I   | •         |                 | _        |                                      |              | II. |           | 1          |                                  | ]   | II. |                | IV.                    |                            |             |                   |  |
|--------------------------------------|-----|-----------|-----------------|----------|--------------------------------------|--------------|-----|-----------|------------|----------------------------------|-----|-----|----------------|------------------------|----------------------------|-------------|-------------------|--|
| Years b                              | ef  | ore       | Chr             | ist.     | Year                                 | 's ai        | ter | Chi       | rist.      | O's motion for Bissextile years. |     |     |                |                        |                            |             |                   |  |
| Solar<br>Julian<br>Secular<br>years. | (   | ⊙'s<br>mo | me:<br>tion     |          | Solar<br>Julian<br>Secular<br>years. | <del>-</del> |     | me        |            | Years                            |     |     | mean<br>tion.  | ⊙'s me<br>either ascer | otion for 4<br>iding or de | yea<br>esce | irs<br>ending.    |  |
|                                      | s.  | •         | ,               | "        |                                      | 5.           | •   | ,         | *          |                                  | _   | 1   | #              | 37                     | ·                          |             |                   |  |
| 4000                                 | 8   | 7         | 19              | 59       | 0                                    | 9            | 7   | <b>57</b> | 5          | .4                               |     | 1   | 50,23          | 1 ea                   | rs ascendi                 | ng.         |                   |  |
| 3000                                 | 3   | 14        | 59              | 15       | 100                                  | 9            |     | 43        | 1          | 8                                |     |     |                | 1st Common             | year                       | 41'         | 43",8             |  |
| 2000                                 | 8   | 22        |                 | 3.5      |                                      | 9            |     | 28        |            | 12                               |     |     | 30,68          |                        | do                         | 30          | 29,3              |  |
| 1900                                 | 1   |           |                 | 27       | 300                                  |              | 10  |           | 52         | 16                               |     |     | 20,90          | 1                      | do                         |             | 9,3               |  |
| 1800                                 | 3   | 21        | .10             | 23       | 400                                  | 9            | 11  | 0         | 48         | 20                               |     | 9   | 11,13          | 4th Bissextil          | e                          | 1           | 59,2              |  |
| 1700                                 | 8   | 24        | 56              | 19       | 500                                  | 9            | )1  | 46        | 43         | 24                               | _   | 11  | 1,36           | Year                   | s descendi                 | ng.         |                   |  |
| 1600                                 | 8   | 25        | 42              | 14       | 600                                  | 9            | 12  | 32        | 39         | 23                               |     | 12  |                | 1st Com. yes           |                            |             | 5' 40",5          |  |
| 1500                                 | 8   | 26        | 28              | 10       | 700                                  | 9            | 13  | 18        | 35         | 32                               |     |     | 41,80          | 2d do. de              | ). + 11 2                  | 9 3         | 31 21,0           |  |
| 1400                                 | 8   | 27        | 14              | 6        | 800                                  | 9            | 14  | 4         | 30         | 36                               |     | 16  | 32,03          |                        | 0. 1-11 2                  |             |                   |  |
| 1300                                 | 8   | 28        | Q               | 1        | 900                                  | 9            | 14  | 50        | 26         | 40                               |     | 18  | 22,26          | 4th Bissexti           | le. + 0                    | 0           | 1 50,2            |  |
| 1200                                 | -   | 28        | A 5             | <br>57   | 1000                                 | _            | 15  | 36        |            | 44                               | i — | 90  | 10.40          | SUPPLEM                | ENTARY '                   | ľAi         | BLE.              |  |
| 1100                                 | 18  |           |                 |          | 1 1                                  |              |     | 22        | ' '        | 43                               |     | 20  | 12,49          | Collective n           |                            |             |                   |  |
| 1000                                 | 9   |           | 17              | 48       | 1200                                 | -            | 17  |           | 13         | 52                               |     |     | 52,95          |                        | ch Sclar m                 |             |                   |  |
| 900                                  | 9   | 1         | 3               | 14       | 1300                                 |              | 17  | _         | 9          | 56                               |     |     | 43,17          | · }                    | Tamul                      | 1 2         |                   |  |
| 800                                  | 9   | _         | 49              | -        | 11 -                                 | -            | 13  |           | 4          | 60                               |     |     | 33,40          |                        | names.                     | ă           | Number<br>of days |  |
| 700                                  | -   |           | 9.5             |          | 1500                                 |              | 19  | 06        | 0          |                                  |     |     | 02.62          | Vaisácha               | Chaitram                   | 17          | 30                |  |
| 700<br>600                           | 9   |           | $\frac{35}{21}$ | 35<br>31 | 1500<br>1600                         | t ·          | 20  |           | 5 <b>6</b> | 64                               |     |     | 23,63<br>13,86 | Jyaishtá               | Vyassei                    | ರ           | 62                |  |
| 500                                  | 9   |           |                 |          | 1700                                 |              |     | 57        | •          | 72                               |     | 33  | 4,08           |                        | Auni                       | П           | 93                |  |
| 400                                  | 9   | _         | 53              |          |                                      |              |     | 43        |            | 76                               |     |     | 54,30          |                        | Audi                       | 9           | 125               |  |
| 300                                  | 9   |           |                 | 18       | 11                                   |              |     | 29        |            | 80                               | Ì   |     | 41,53          | Emiorapada             |                            | 3           | 155               |  |
|                                      | . _ |           |                 |          | 1300                                 | _            |     |           |            |                                  | İ_  |     |                |                        | Paratasi                   | 吹           | 186               |  |
| 200                                  | 9   | 6         | 25              | 14       | 2000                                 | 9            | 23  | 15        | 38         | 84                               |     | 3\$ | 34,76          |                        | Arpesi                     | ≏           | 216               |  |
| 100                                  | 9   | _         | 11              |          |                                      | 10           |     |           | 54         | 88                               | 1   |     | 24,99          | Margasiras<br>or       | Cartiga                    | m           | 246               |  |
| 0                                    | 9   | 7         | 57              | 5        | 4000                                 | 10           | 8   | 34        | 11         | 92                               | }   |     | 15,21          | Agrahayan              | 53115                      | 1"(         | ~=0               |  |
| p                                    |     | ·         |                 |          | 1                                    |              |     |           |            | <del> </del>                     | -   |     |                | Paushia                | Margali                    | 1           | 275               |  |
| •                                    |     |           |                 |          | 300                                  | *            | 2   |           | 46,98      |                                  |     | 44  | <b>5,4</b> 3   | Mágha                  | Tye                        | \v*         | 305               |  |
|                                      |     |           |                 |          | 400                                  | Ì            | 3   |           | 42,04      | 1                                | *   | 45  | 55,66          | D'hol/guno             | Maussi                     |             | 334               |  |
|                                      |     |           |                 |          | 500                                  | 1            | 3   | 49        | 38,30      | 200                              | 1   | 31  | 51,32          |                        | Poongoni                   |             |                   |  |

Application of this Table for finding the Sun's mean Longitude on the 1st January of any Bissextile Julian year, and on the 31st December of any Common year of the same style.

| Example I.                                                                     | Example 11.                        |
|--------------------------------------------------------------------------------|------------------------------------|
| Wanted the Sun's mean Longi-                                                   | Wanted the same for A. D. 542,     |
| tude for A. A. C. 720, a Bissextile.                                           | a common year.                     |
| By col. I A. A. C. 700 9 2 35 35                                               | ByCol.II A.D. 500, 9 11 46 43,0    |
| Col III 6 00 0.11.12                                                           | Col. III for 40 years. 18 22.26    |
| Mean Long. sought 9 2 26 23,87                                                 | Col. IV for 2 years, 11 29 31 21,0 |
| and the year being a Bissextile                                                | Mean Long. sought 9 11 36 26,26    |
| one, the Longitude so found is fer<br>the 1st January at noon A. A. C.<br>720. | and the year being a Common one,   |
|                                                                                | •                                  |

EXAMPLE III.
Wanted the same for A. D. 1816,
a Bissextile year.

By Col. II A.D. 1800, 9 21 43 47,0 Col. III for 16 years, 7 20,9 Mean Long. sought 9 21 51 7,9 and the year being a Bissextile one, the Longitude so found is for 1st January A. D. 1816.

TABLE LII.
PART THE SECOND.

Shewing the Sun's mean motion for days, hours, minutes and seconds, constructed by means of Delalande's Solar Tables III and IV (Edition of 1764). The Supplementary Table being for deducing the European monthly date from any number of days elapsed of the Julian year.

|                |   | 1             |             |                             |        | 11.            |                      |        |      |                      | III.           |       |                       |                | Ÿ                             | RY TABLE.                                          |                 |  |
|----------------|---|---------------|-------------|-----------------------------|--------|----------------|----------------------|--------|------|----------------------|----------------|-------|-----------------------|----------------|-------------------------------|----------------------------------------------------|-----------------|--|
| Days.          |   | _             | i m<br>otio | ean<br>n.                   | Hours. | m              | O's<br>ean<br>tion.  | Hours. | m    | )'s<br>ean<br>tion.  | Minutes.       | n     | ⊙'s<br>aean<br>otion. | Seconds.       | ⊙'s<br>mean<br>moti-<br>en.   | Shewing the lective no lof days elective at the en | mber<br>psed    |  |
| 1<br>2<br>3    | 0 | 1             |             | 8,3<br>16,7<br><b>25</b> ,0 | 2      | 2<br>4<br>7    | 27,8<br>55,7<br>23,5 |        | 41   | 25,5<br>53,4<br>21,2 |                | . 000 | 2,5<br>4,9<br>7,4     | 1<br>2<br>3    | 0,0<br>0,1<br>0,1             | each Euro<br>month.                                |                 |  |
| 4<br>5<br>6    | 0 | 4             | 55          | 33,3<br>41,6<br>50,0        | 5      | 12             | 51,4<br>19,2<br>47,1 |        | 49   | 49,1<br>16,9<br>44,8 |                | 000   | 9,9<br>12,3<br>14,8   | 4<br>5<br>6    | 0,2<br>0,2<br>0,2             | January February March April May                   | 59<br>90<br>120 |  |
| 9              | 0 | 7<br>8        | 53<br>52    | 58,9<br>6,0<br>15,0         | 9      | 19             | 14,9<br>42,8<br>10,6 | 23     |      | 12,6<br>40,5<br>8,3  | 8              | 0 0   | 17,2<br>19,7<br>22,2  | 9              | 0,8<br>0,3<br>0,4             | June<br>July<br>August<br>September                |                 |  |
|                | 0 | 9<br>19<br>29 | 42          | 23,9<br>46,6<br>9,9         | 11     | 27             | 38,5<br>6,8<br>34,9  |        |      |                      | 10<br>20<br>30 | 0 0 1 | 24,6<br>49,3<br>13,9  | 10<br>20<br>30 | 0,4<br>0,8<br>1,9             | October<br>November<br>December                    | 365             |  |
| 40<br>50<br>60 | i |               | 16          | 33,9<br>56,5<br>19,8        | 14     | 32<br>34<br>36 | 2,0<br>29,9<br>57,7  |        |      |                      | 50             | 1 2 2 | 38,6<br>3,2<br>27,8   |                | 1,6<br>2,1<br>2,5             | N. B.—In sextile y one day is added to             | ears,           |  |
| 70<br>80<br>90 | 2 | 18            | 51          | 43,1<br>6,4<br>29,7         |        |                |                      | •      |      |                      |                | -     |                       |                | ble and<br>Astro-             | respective<br>from Febr<br>downward                | ruar <b>y</b>   |  |
|                | G | 17            | · 7         | 53,0<br>45,0<br>39,0        |        | cond           | l part               | is 80  | if-e | vident               | , and          | l th  | erefor <b>e</b>       | requ           | ig: the<br>ires no<br>sion to | . ,                                                |                 |  |

use these Tables may not have that work at their disposition, it may be proper to state that for the sake of conveniency they were arranged on the following principle.

If you have the Sun's mean Longitude for any annual Epoch and you want it for the next, add his motion for 365 days, which is 11° 29° 45′ 40″,5, if the following be a Common year: but if it be a Leap one, add overmore, the ©'s mean motion for one day, i. e. 59′ 8″,3, in all 44′ 48″,8 : and the Longitude so obtained will be for the 1st January in all Bissextile, and for the 31st December in all Common years. The aggregate of 1, 2, 3 and 4 years equation is given in column 4th, part 1st, of this Table, and is to be applied as follows, for descending years.

#### EXAMPLE IV.

Let the Sun's mean Longitude on the 1st January 1816, be found to be

On the same principles the Equations for ascending years, such as those before Christ, are to be applied to the Longitude due to the given Epoch with contrary Signs.

#### EXAMPLE V.

Let the Sun's mean Longitude on the 1st January A. A. C. 720, be (Ex. I.)

I shall now give Examples to shew how to find the Sun's mean Longitude for any particular day or instant, both according to Delalande's Tables, and Table LH.

#### 10 By Delalande's Tables.

N. B .- In Bissextile years if the proposed date falls in January or February, retrench one day therefrom.

#### -EXAMPLE VI.

Wanted the Sun's mean Longitude for the 11th March A. A. C. 720, at 6" 49' 10" p. m.

Here there would be no difference in the process if, instead of Delalande's, we had used Table LII, because in counting the number of days elapsed from the beginning of the year to the 11th March, we would take 31 days in January, 29 in February, and 11 in March: in all 71 days. But because the proposed year is a Bissextile one, and consequently the Sun's mean Longitude at its beginning, is given for the 1st January at noon, one day is to be retrenched from the sum; the remainder is therefore 70 days, with which referring to the 1st column of the second part of Table LII, we find 2'8' 59' 43',1, the same quantity as is given in Delalande's Table for the 11th March.

#### EXAMPLE VII.

#### 20 By Table LII.

But if the number of days elapsed are not to be found at once in Table LII, then it must be divided into two parts or more, as the case may require, thus:

Let the Sun's Longitude be required for the 15th March, at 0° 0' A. D. 1817,—We have in January 31°, in February 28, in March 15, sum 74 days.

|                  |                 |                |                   |      |   | 3.   | •  | •    |   |
|------------------|-----------------|----------------|-------------------|------|---|------|----|------|---|
| By Example IV,   | ⊙'s mean Lo     | ngitude 31st D | e <b>cember</b> : | 1816 | • | 9 21 | 29 | 27,5 |   |
| By Table LII, pa | rt 2, col. 1, 1 | for 70 days    | •                 | •    |   | 28   | 59 | 43,1 |   |
| do.              | do.             | 4 days         |                   | . •  | - | 0 .3 | 56 | 33,3 |   |
|                  | ⊙'s m           | ean Lonzitude  | sought            |      | - | 0 4  | 25 | 43.9 | • |

The same result would have been obtained by Delalande's Tables, by the addition of only two quantities:

There remains only to shew how, by means of the same Tables, the time may be deduced from the Sun's mean Longitude, which is only the converse of the preceding operations, but is to be done by trials when the year is known.

EXAMPLE VIII.

The operation by Table LII is a little longer than by those of Delalande's, owing to the Sun's motion not being registered in it for every day in the year; but it is to be performed by the same process.

```
O's mean Longitude 31st December 541
                                                         9 11 26 26.2
    Table LII, part 2, column I
                                                                7 46,0 200 days.
                                                        2 28 42 29,7
                                                                        90
                                                        0
                                                            7 53
                                                                  6,6
                                                            0 17 14,9
                                                                         7 hours.
                                                               1 38,6
                                                                        40 minutes Os.
                        298 days, 7" 40' 0"
                                                            5 38 42,0
Now by the Supplementary Table, part 2, we have
                  To the end of September
                                                        273 days.
                  Number of days above found
                                                        298
                                            October
                                                         25th
```

The difference of the results by the two sets of Tables is therefore only 1 second of time. It need not be observed, that those who possess Delalande's Tables, will find them the most convenient of the two.

Of the Supplementary Table, Part the First.
Suppose that 293 days have elapsed of the Christian year 542, let it be required to find the Rindu Solar Sydercal date answering to that period which, by the preceding Example, we have found to answer to the 25th October of the said year.

Having determined by the usual process that the Hindu year began on the 19th March, say: from the beginning of the year to the said date there have elapsed 78 days.

But the days expired by proposition are 208
Subtract 78

220
By the Supplementary Table, part I, to the end of Arpesi 216

which shows that the 25th October 542, answers to the 4th of the Tamul month Cartiga; or of the Bengal one Margasiras.

# INDIAN

# CHRONOLOGICAL TABLES,

WITH DIRECTIONS FOR USING THEM.

|   |     | • , |   | • | • | • | 1 |  |  |
|---|-----|-----|---|---|---|---|---|--|--|
|   |     |     |   |   | • |   |   |  |  |
|   |     | •   |   |   | 4 |   | • |  |  |
|   |     | •   | t | • | • |   |   |  |  |
|   |     |     | • | • | 4 |   |   |  |  |
|   |     | •   |   |   | 4 |   |   |  |  |
|   |     |     |   | • |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   | • | • |   |   |  |  |
|   |     |     |   |   |   | • | • |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     | • | • |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   | ·   |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   | • |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     | •   |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   | _ |   |  |  |
|   |     |     |   |   |   | • |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   | , |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   |     |     |   |   |   |   |   |  |  |
|   | • • |     |   |   |   |   |   |  |  |
| • |     |     |   |   |   |   |   |  |  |

## AN ACCOUNT

Of three Chronological Tables, the contents of which were calculated on the principles disclosed in the Kala Sankalita; exhibiting the numerals, names, characters, and epoch of commencement, or end, according to European account, of 300 Solar and Luni-solar years, concurring with those of the Christian XVIIth, XVIIIth, and XIXth Centuries; and including eight different Styles, each being used in some part of India.

Also the concurrence of the Christian years with those of the Hejira, and the Epoch of commencement of the latter from A. D. 622 (A. H. 1) to A. D. 1900 (A. H. 1318).

THE doctrines contained in the Kala Sankalita, seem at first sight to be such as to interest only those who intend to make a particular study of Indian Astronomy and Chronology; but little adapted to the occasions and taste of that class of readers for which it was originally intended. On a nearer view however, it will be discovered that although a knowledge of the theories which were investigated in that work, may be dispensed with for using the Tables under consideration, yet in our present state of information on the Elements of Hindu Astronomy, on which Indian Chronology must rest, the latter could have given no satisfaction to any class of readers if they had appeared for the first time supported by no sort of authority.

It is moreover to be considered, that the higher questions on Chronology which may be proposed, such as refer to Astronomy, cannot be resolved by any set of Tables only; and that, in such cases, the most ingeniously contrived and most elaborate Tables, require the assistance of theory.

Yet I am prepared to hear it said that in the elementary part of this work, I have exceeded the necessary bounds of an introduction, and that it would have sufficed, since the production of the Chronological Tables was its ultimate

object, to have exhibited the leading features of the systems according to which the Hindus divide time, without entering into those considerations on their manner of operating, which fills so considerable a part of the volume. To which objection I shall answer that had I done so, I would have done nothing; because the difficulty consists principally in our not understanding yet distinctly the mechanism of their computations. For although we have many excellent and profound tracts on the general structure and principles of Hindu Astronomy, yet I do not know of one that would have clearly explained any of the columns of the Tables referred to, although none aspire to any thing higher than the resolution of very simple questions respecting time.

But independently of the above considerations, there is another one, which is of a local nature; and which, if it be true that it applies to our Indian public, must a fortiori, act with reduplicated force on all European readers and critics.

There is in every country of Europe a numerous class, which although it cares little for abstract science, yet is well disposed to benefit by its speculations, when aiming at useful results; provided some well qualified person, or body of men, will stand forward, and vouch for the soundness of the principles on which any improvements proposed to its adoption, is grounded: Thus on the signature of some of the members of the Board of Longitude, or of the Academy of the Sciences, the Legislature will adopt, without further examination, a set of new Astronomical Tables, or a new standard measure; and the whole nation will trust to both, without caring if Mendoza valued the accuracy of his Tables more than his life; or how many degrees of the meridian, Delambre and Lambton measured on the surface of the earth.

But in matters of science (and in such matters only), the case stands otherwise in India. If authors are rare among us, critics are still scarcer. Business, in all its various acceptations, is the main spring of the actions of the community. The ministers and officers of a great and powerful sovereign, (as Marquis Wellesley emphatically called the Civil Servants of the Company), the Proconsuls who, under the name of Political Residents, govern the courts of Native Princes; and the Merchants, whose whole attention is fixed on the success of

their own adventures, have too little leisure to attend to the abstract speculations of the unoccupied; and the military class, like that of every other country, seeks laurels in its appropriate fields.

When, therefore, a production out of the common walks of literature, makes its unexpected appearance, and tries to recommend itself on the score of utility, no one is to be found to imprint that scal upon it, which, like the King's mark on a piece of plate, would cause its practical object to be adopted by the public without a question; and in such a case there being no one to judge for all, every body expects to be enabled to judge for himself.

The same reasons will induce an European reader to be still less confident; for at least in India in a case of peremptory necessity, the Native Sastras may be resorted to; and although they may not be able to convey demonstration according to our own mode of argumentation, many will pronounce with perfect certainty on questions which refer to their theories.

But to what critic in Europe is the reader to address himself, for settling his opinion on a work of this kind?—If the rudiments of Hindu Chronology are so little known to us, who have (not uneducated) spent the most active part of our lives among the Indians, by what criterion, short of a full exposure of its component parts, will be pass judgment on an insulated instrument, which purports to measure time according to the fancies of nations, some of which he perhaps never heard of in the course of his life?

It was therefore not only necessary to draw these oriental elements out of the hidden shelves of the Native Astronomers, but to publish them in toto, that the L dian Chronological Tables now presented to the public, might be appreciated according to the degree of merit which they may possess. Thus an Indian author who lights the midnight lamp, and gropes unaccompanied, through the obscure and endless windings of Hindu Astronomy, is not only bound to common accuracy, but (if he rightly calculates his chances of success) he must levy, train and even arm critics, where none were before to be found; and weapens procured by himself, must lie at all times at the disposal of whoever may feel disposed to turn them against his production.

On the use and application of the Tables.

In giving an account of the Chronological Tables, I shall assume that the reader has not perused a line of the Kala Sankalita; and that he is totally ignorant of Hindu Astronomy: but that his object is solely to find, with as little trouble as possible, what Indian or Mahommedan year (of a specified account of time) corresponds to a proposed European year. To determine furthermore the Epoch when the year sought commences or ends; and lastly, to fix the date of commencement of any Hindu Solar or Mahommedan month, when that of the beginning of the year is known, with reference to the European Kalendar, and vice versa.

I shall not detain the reader by a tedious description of each column of the three Tables: the best and readiest account that can be given of these is to refer him to the headings of each, which are sufficiently explicit to dispel all fears of confusion.

Supposing therefore, that their respective contents are known, I shall proceed and give examples of each of the above enumerated cases, propounding first any specific Christian year, according either to the old or new styles; and requiring the name, character and beginning of any year registered in the Table.

#### EXAMPLES.

I.

First Chronological Table, Let it be proposed to find the years of all the styles referred to in the first Chronological Table which answer to A. D. 1824, N. S.

The Christian year,

1º Find the year 1824 in the first column on the left, and keep the eye on the same line.

The numeral of that of the Cali yug.

2º You will find in column III, that the year of the Cali yug which expires in the month of April is the 4925th; and consequently that the current one after the renewal of the year, is the 4926th.

Do. of Salivahana.

3º By column IV, that the year Saca, or from the birth of Salivahana, which expires in April, is the 1746th; and that the year which begins then is the 1747th Saca.

Of the Alra of Para-

4°. By column V, that the year of the Æra Parasurama which ends in the

month of September 1824, is the last or 1-1000th year of the 3d Cycle of the same number of years.

5. By column VI, that the Solar year of the Æra Grahaparivrithi, which ends in April with the common Solar year, is the 48th of the 20th Cycle complete; and that the next year is the 49th of the 21st Cycle current.

Of the Grahapari-

6º By column VII, that the Vrihaspati, or Jupiter's year which begins or rather which is supposed to begin) in April 1824, according to the Surriah Siddhanta is Manmat'ha, the 29th of the Cycle of 60 years (Bengal).

Name of Jupiter's year according to the Surriah Siddhanta,

7º By column VIII, that the same Vrihaspati year according to the computation of the Tellingas is Tarana, the 18th of the Cycle (Peninsula).

Do, according to the Tellingas.

# For the commencement of all these years.

#### 11.

1º By column IX, we find that the year of the Cali yug 4925 ends, and the 4926th begins on Sunday the 11th April 1824, Civil account.

Beginning of the Solar year, Civil and Sydereal,

- 2º By column X, that A. C. 4926 began on the 10th of April, at 51 guddins, 15 viguddias, Hindu time (20° 30' European time) after that of Sun rising at Larca.
- Solar and Luni-solar years, their specific duration is not considered in any part of India: and on that account their beginnings are not registered in the Table, though these may be ascertained as precisely as any other.
- 4? The 1000th year of the 3d Cycle of Parasurama by column V (2d div.) ends on the 14th September 1824: and the following is the 1st year of the 4th Cycle.

Of the year of Parasurama.

#### NOTE.

Previously to A. D. 1752, the Julian Kalendar alone was used in England. On that account a section of column IX gives the date of beginning of the Solar year, according to the old style, from A. D. 1600, to 1750. The two years that are wanting to reach the Epoch of the reformation, not being of sufficient importance to introduce that column in the Table of the second half of the eighteenth century, have been neglected; but may easily be replaced by the reader, if the occasion should require it.

The same according to the Julian style.

The expurged year of Jupiner's Cycle, by the rules of the Surrish Siddhinta corrected by the Tika, and that by the Jyantistava, do not fall at the same Ppoch.

It is also to be observed that during 13 years of a Cycle of 86 years, the Vrihas pati mana according to the Surriah Siddhanta, and Jyautistava, vary; the latter in present times expunging one year out of the Cycle, 13 years before the former. When that case occurs, the Chacra year according to both accounts, is inserted opposite to the same Christian year; that by the Surriah Siddhanta being uppermost. It is therefore necessary, when expounding a date by the sole means of the recorded year of Jupiter, to ascertain which style was prevalent in the country where the document was found or executed. This caution, although already given, in another part of this work, cannot be too often repeated for preventing mistakes.

Example.

To give an Example of the two cases under consideration, I shall select A. D. 1680; answering to the 4781st year complete of the Cali yeg. On referring to the first Chronological Table it appears, that whereas the Civil year 4782 began on Monday the 8th April N. S. (column IX), the same Monday answers to the 28th March O. S. (2d part of the same column).

And whereas the Vrihaspati year, which answers to the 4782d year of the Cali yug, is Sucla, (the third of the Cycle) according to the Surriah Siddhanta corrected, it is Pramoda (the 4th) by the Jautistava rule.

It is hardly necessary to add, that the letter B annexed to the numeral of any Christian year, or to the date of beginning of a Hindu Solar year, indicates that it is one of 366 days; called Bissextile when referred to the former. It is proper however, to state, that the Hindu Leap years so indicated, are derived from the Syderical ones. (Vide 1st Memoir, page 12.)

The Rengales R ler year called den. The XII:h column of the first Chronological Table refers to an account of time totally unknown in the Peninsula of India, but used in the Province of Bengal. It registers the years expired of a style written Sen, but pronounced Son, on the beginning of the common Solar year. The following particulars, which I owe to the favor of Dr. Wilson of the Bengal Service, and which were procured on a reference which I made to him through the kind intervention of my friend Lieutenant Colonel Blacker, (\*) constitute all the knowledge I possess on the subject.

<sup>(\*)</sup> Surveyor General of India.

"The Bengal year or Sen (pronounced Son) 1232 began this year on the "11th of April, corresponding to their 1st of Vaisacha—this is the Solar year. But the Lunar year begins on the day of the new Moon in Chaitra, and dates by the same æra, being adjusted to the Solar year by the intercalation, when "necessary, of a whole month.

"When the Bengal Sen was instituted I have not been able to learn, but it is said by some to have been the act of one of the Mahommedan Kings of Bengal; and it seems to bear reference to the Hejira year, differing from it at present but 8 years.—It seems likely to have originated in some clumsy attempt to make the Hindus adopt the Mahommedan computation numerically, without adjusting their Solar to the Lunar year of the Hejira. Consequently in about three centuries, it will have lost eight years, or thereabouts, and this corroborates the tradition which assigns its introduction to the Mahommedan Kings of Bengal. We have the same date in use on this side of India, in Tirhut, and the Western Provinces.

"The Vilaity and Fusselee years, are at present also 1232: they are both "Solar years, but differ in their outset. The Vilaity year is reckoned from the first of the Krishna Pacsha, or Moon's wane in Chaitra,—and the Fusselee on the same in the month of Ashar. With the difference of a few months, however, they run parallel with the Sen, or year of Bengal, and probably originated in a similar mistake."

"In saying that they run parallel, however, I mean merely as to the date of the year through a long series, for the months and days do not always correspond."

From the above account we conclude that the numeral of the Sen year, serves to designate both the Solar, and Luni-solar years, in the same manner as the names of those of the Cycle of 60, or Vrihaspati years. The way of finding by the Chronological Tables the numeral of the Bengalee year which concurs with any Christian year, is therefore the same in both cases, and requires no particular Example.

N. B.—As the Solar year used in Bengal is that of the Surriah Siddhauta (3654 155 31 319 245), whereas that of the Peninsula is the year according to

the Aria Sildhanta, (2654 155 31° 15°), there will occasionally be found the difference of one day between the beginning of the Saura Mana, as registered in the first Chronological Table, and that which is current in Bengal; for the reasons stated at pages 63 and 118, in the 1st Appendix p. 239, and pages 62 and 65 of the Tables of the Kalu Sankalita. Thus whilst the present Solar year 4927 of the Cali yug is taken on the Coast to begin on the 11th April; the same year is accounted to commence in Bengal on the 12th April 1825.

It would have been impossible to notice that difference in the General Table, which was principally constructed for the use of the people of the Peninsula.

#### III.

Second Chronological Table, Luni-solar style.

The second Chronological Table, refers solely to the Luni-solar Astronomical year of the Hindus, called in the Peninsula the Siddhanta Chandra Mana. As the construction of that year is very complex, it was not found possible to render the arrangement of the articles registered in its columns, so simple as that of the preceding ones; a proper attention to the following explanations will however, suffice for preventing mistakes.

Column I and II require no explanation.

Column III indicates what is called in this work, the character of the Lunisolar year, which begins during the Christian year registered in a line with it; namely, whether it be a common one of 12 Lunar months; an intercalary one of 13; or lastly, a double intercalary year with an expunged month, being also of 13 Lunar months; two being repeated, and one being left out. (\*)

Lal.cation,

When the approaching Luni-solar year is a common one. 1º When the space opposite to the year expired of the Cali yug, registered in the 2d column, is left blank, it is a sign that the Luni-solar year which is about to commence, is a common Sumvat sara, and consequently consists of 354 Solar days.

2. When the letter A is inserted in the said column, it shows that the Lunisolar year which is commencing is an Adigah sumvat sara, or intercalary year, and therefore that it consists of 384 Solar days. (†)

An intercalary one.

<sup>(\*)</sup> Vide Key to the Siddhanta Chandra Mana, page 71.

<sup>(†)</sup> For computing what month is to be repeated, see do. page 142.

3º And when the letters AC are found in the same column, it indicates that the new year is a Cshaya sumvat sara, or double intercalary year with an expunged month. (\*)

A double intercalary year with an expunged mouth.

How these circumstances were determined may be seen in the 3d part of the Second Memoir, which begins at page 149, the particulars of which are foreign to the object of this article.

It is to be well understood, that in all the cases registered in the second Intercalations, Chronological Table, the intercalation, or suppression of a Lunar month in the approaching Chandra mana, will occur in all the Christian years registered in a line with the character, in the first column; but only in the Luni-solar year which begins on the expiration of that the numeral of which is given in the second; for in present times the renewal of the Hindu Luni-solar year occurs generally in March, or the beginning of April, so that the same Christian year answers in part to two Hindu ones; and the intercalation always occurs in the latter part of the former. (†)

EXAMPLES.

1º Let the same Christian year 1824, answering to the 4925th and 4926th year of the Cali yug, be proposed.

By Column III, which is left blank, in the same line with 1824, we see that the Luni-solar year 4926 of the Cali yug is a common one, i. e. of 12 Lunar months, or 354 Solar days.

What indicates a common Luni-solar

2º But let A. D. 1801 be proposed, then the letter A opposite to it, in col. III, shews that a Lunar month will be intercalated in the year 4903 of the An intercalary. Cali yug, being the next to 4902 in the 2d column; and therefore, that the former will consist of 13 Lunar months or 384 Solar days.

3? Lastly, let the Christian year be A. D. 1822. As we find the character to, Adouble interculary be A. C. in the 3d column, we conclude that two months will be repeated, and

with an expunged

<sup>(\*)</sup> For what month is to be expunged, see Key to the Siddhanta Chandra Mana, page 137.

<sup>(+)</sup> A different arrangement would have confounded all references to the body of the work, in which the Indian system of notation was preserved. The Aharganas given in the IXth and Xth columns would also have no longer tallied with the dates given in the IVth, Vth and VIth, which would have prevented all means of verification.

one expunged in the 4924th year of the Cali yug: so that the Luni-solar year, as in the preceding case, will consist of 13 Lunar months, or 384 Solar days.

How the months to be intercalated, or expunged, are to be determined, is not of the competency of these Tables alone; but the resolution of these Problems will be found at Article 6, Part II, page 142 of the Key to the Siddhanta Chandra Mana, and other places.

Column IV gives the last feria, or weekly day of the Luni-solar year whose numeral is inserted in the second column.

Column V gives the European date of the last mean conjunction, according to Hindu computation (derived from the Ahargana inserted in column X), which determines the end of the Luni-solar year registered in the 2d column.

Column VI gives the date of the last conjunction in the year, according to Hindu Solar Sydereal account, and because the Luni-solar year always begins during the last month of the Solar year, the dates therein registered, refer invariably to the Solar month Chitra, the same as the Tamul Poongoni.

This column, independently of the Solar Sydereal, also furnishes the means of finding the Civil date of the last day in the Luni-solar year; the difference of which is indicated by a stroke before the figure, implying that the numeral of the Civil Solar date, is by one day less than the Sydereal one.

Thus if I want the Solar Sydereal and Civil date of the last day in the year 4923 of the Cali yug, answering to A. D. 1822, I find in column VI opposite to that Christian year, 13th Chitra, which is the Sydereal date; but as there is a stroke — before it, I conclude that the Civil date is the 12th of the same month. (\*)

<sup>(\*)</sup> Vide Key to the Siddhanta Chandra Mana, page 82, for the manner of calculating these dates: but as in the article referred to, the Solar Ahargana which was used, is that by the Surriah Siddhanta, whereas that by the Chronological Table is the Ahargana according to the Aria Siddhanta (which is preferred by all modern Sastras) the results will differ by one day in the Sydereal, though not so in the Civil account, as may be seen by the following computation, which shews the connection of the columns and of the Tables.

Luni-solar do. col. X, 2 1798166 20 12 30

Luni-solar do. col. X, 2 1798148

Difference 18

And lastly, by inference, since the Solar Civil date of the last conjunction in the year 4923 of the Cali yug fell on the 12th Chitra, it follows that the Prathama Tidhi, or first Lunar day of the Luni-solar year 4924, fell-on the 13th Chitra of the Solar year 4923, i. e. 19 days before the end of the said year; as was exemplified in the Kalendar exhibited at page 67 of this collection.

This last consideration leads us to another one which may be easily understood, namely, that with reference to the Cycle of Jupiter of 60 years, the Lunisolar will change its name 19 days sooner than the Solar one, the former being called Vijya from the 24th March 1822, and the latter still Nandana until the 11th April, as may be seen on referring to the first Chronological Table.

In what has been said touching the date of the Prathama Tidhi of any year or month, the reader, who is supposed to be unacquainted with the text, must be warned that its being coupled with a particular Solar date, depends on its having begun before, or at Sun rise; in which case it is coupled with the Solar date with which it mainly coincides.—Or in the latter supposition that it begun after Sun rise, for in that case it is registered along with the ensuing Solar day. And lastly, that if the said, or any other Tidhi, begins and ends between two

To expound the feria Monday, 1st Chitra, we find by Chronological Table I. column 2, that the Dominical Letter according to the Gregorian Kalendar of the year 1322 is F; with which referring to any Kalendar about the 11th March about 30 days before the 1st Vaisa'cha shewn by the Table to any Kalendar about the 11th March about 30 days before the 1st Vaisa'cha shewn by the Table to fall on the 11th April) we find that Monday the Sydereal date, actually falls on the 11th March; but on account of the 59 guddias in surplus (exceeding 305) on the 12th Civil account.

From this computation it is manifest that the Sydereal Solar month Chitra counts 31 days and the Civil only 30, (because the fractional Root for Vaisa cha was only 20 gud.) If nce if from 1st Vaisa cha, or 32 days from the 1st Chitra, we retrench 19, there remains 13 for the Sydereal date sought, and for the same reason the Civil date will be 12th Chitra.

to be increased by one day, because the Solar counts from Friday, and the Luni-solar from Thursday = 19 days.

<sup>2</sup>º By Chron. Table I, col. XI, we find for the same year Root - Thursday (10) 20 12 30 giving Thursday the 11th April, Civil and Sydereal account.

Sun-risings on the same Solar day, it is entirely left out of the Luni-solar Kalendar. (\*)

Thus the VIth column of the second Chronological Table expounds three cases by mere inspection, which cannot be resolved by the common rules without very considerable labour. It is almost needless to add, that when the true time of Sun rising is referred to, as it occurs in any Latitude or Longitude arbitrarily proposed, the precise Solar date of the Amavasya, and Prathama Tidhis, above considered, may vary from what it is computed for Lanca in the Chronological Table. But as this difference can only occur when the last conjunction falls very near the time of Sun rising, the case is a rare one, and at all events cannot affect the Tabular results, more than one day one way or the other.

The VIIth, VIIIth, IXth and Xth columns of the 2d Chronological Table, can only be of use to those who, having learnt the methods disclosed in the Kala Sankalita, might wish to compute the minuter circumstances of the Luni-solar year, with a view to fix an Epoch with great precision. They are intended to save the computer a vast deal of trouble, and occasions of mistakes, in furnishing him at once with two of the Elements on which all Luni-solar computations depend; and also for giving to the uninformed an opportunity of tracing the connection between the Solar and Luni-solar divisions of time.

Column XI registers the year expired from the origin of the æra of Vicramaditya, a style which is used to number the Luni-solar years from an Epoch more recent than the beginning of the Cali yug; in the same manner as the æra of Salivahana is applied to the Solar years.

Thus if the numeral of the Luni-solar year which ends in A. D. 1824 be required according to the style of *Vicramaditya*, we find by the column referred to, that it is the 1181st, ending on the 30th March of the said Christian year.

IV.

Third Chronological Table, win of the Hejira Lunar years. The third Chronological Table, which is general for all years of the Hejira from A. D. 622 to 1900, is so constructed, that when you have found the

٠,

<sup>(\*)</sup> Vide Key to the Siddhanta Chandra Mans, page 72.

numeral of the Mahommedan year which corresponds to the proposed Christian one, you know (what is called) the Character of the year; by which is meant the feria or weekly day on which it begins; and this Root, or Character, serves to find the commencement of every month in the Lunar year: for the years of the Hejira are arranged in the respective columns according to the day of the week on which each begins. This arrangement though in some respects less convenient than when the common series is followed, has in others, the advantage of avoiding errors when taking the numerals and other indices of the circumstances of the Lunar year out of the Table; and affords great facilities for comparing the Initial Roots and Soota dina of the Indian and Mahommedan years.

The æra of the Hejira is divided into cycles of 30 years, at the end of which, the intercalation of the months, which occur in the 2d, 5th, 7th, 10th, 13th, 16th, 18th, 21st, 24th, 26th and 29th resume the same series. In intercalary years, one day is to be added to the last Lunar month, called Zooledgee; making that, month consist of 30 days instead of 29, which is its duration in common years. These are indicated by the letter B, and the years ending the cycle of 30 years by a stroke = and asterisk \* above and below the same year.

#### EXAMPLE.

Let it be required to find the numeral, and date of the commencement of Example. the year of the Hejira which answers to A. D. 1824.

Referring to that part of the General Table which contains the years of the XIXth century, I find A. H. 1240 in the column under Thursday; its Root is therefore 5: it appears also that its beginning falls on the 14th O. S. and 26th August N. S. and as it is marked with an asterisk, that it is an intercalary one, i. e. of 355 Solar days; its month Zooledge counting 30 days. This process is so simple, that it requires no further exemplification.

To find by means of the first Chronological Table the European date of beginning of each Solar month of the Hindu Sydereal years.

V.

For this purpose I shall give here an abridgment of Table III of the present collection, which will suffice for resolving all common cases.

How to expound the beginning of the Hindu Solar . 4

The Root of days to be counted from Sunday.

|     | Hindu<br>names<br>of Solar<br>months. | Tamul names of months. | Root of duration of every Solar month. | Collective Roots of months according to their standing in the year. | European months concurring N. S. |
|-----|---------------------------------------|------------------------|----------------------------------------|---------------------------------------------------------------------|----------------------------------|
| r   | Vaisácha                              | Chaitram               | D. G. V. P.<br>(2) 55 32 1             | D. G. V. P. (2) 55 32 1                                             | April                            |
| 8   | Jyaishtá.                             | Vyassei                | (3) 21 12 1                            | (6) 19 44 2                                                         | May                              |
| п   | Ashar                                 | Auni                   | (3) 36 38 1                            | (2) 55 22 3                                                         | June                             |
| න   | Srávana                               | Audi                   | (3) 28 12 2                            | (6) 24 34 5                                                         | July                             |
| જ   | Bhádra                                | Auvani                 | (3) 2 10 1                             | (2) 26 44 6                                                         | August                           |
| 哑   | A'swina                               | Paratasi               | (2) 27 <b>2</b> 2 1                    | (4) 54 6 7                                                          | September                        |
| l≏i | Cartiga .                             | Arpesi                 | (1) 54 7 1                             | (6) 43 13 8                                                         | October                          |
| m   | Margasiras                            | Cartiga                | (1) 30 24 2                            | (1) 18 37 10                                                        | November                         |
| 2   | Paushia                               | Margali                | (1) 20 53 1                            | (2) 39 30 11                                                        | December                         |
| 18  | Mágha                                 | Tye                    | (1) 27 16 1                            | (4) 6 46 12                                                         | January                          |
| =   | P'hal'guna                            | Maussi                 | (1) 48 24 1                            | (5) 55 10 13                                                        | February                         |
| ×   | Chaitra                               | Poongoni               | (2) 20 21 2                            | (1) 15 31 15                                                        | March                            |

#### EXAMPLE I.

Examples.

Let it be proposed to find the European date of commencement of the Solar month Jyaishtá (Tamul Vyassei) of the 4926th year of the Cali yug, answering to A. D. 1824.

1º Referring to the first Chronological Table we find opposite to 1824 the Initial Root of the Solar year, - 10th April (6<sup>d</sup>) 515 15v Op

Towhich add that for the month Yaisacha in the above Table (2) 55 32 1

Initial Root Ist of Jyaishtá - (2) 46 47 1

Tuesday, Sydereal: Wednesday, Civil (\*).

2º To expound the monthly dates of these feriæ, we find in the second column opposite to 1824 (1st Chronological Table) that the Dominical Letters for that year, according to the new style, are DC. Referring therefore to any Kalendar with the Letter C, about 30 days after the 10th April, we find that the Tuesday above found, falls on the 11th, and Wednesday on the 12th May, which are the Sydereal and Civil dates of beginning of the Solar month Vaisacha sought.

<sup>(\*)</sup> The Civil account takes one day more when the fraction of the Root in guddias exceed 30.

#### EXAMPLE II.

Let the commencement of the Solar month Magha (Tamul Tye) be required.

D. G. V. P.

The Initial Root for A. C. 4926 remaining as before - (6) 51 15 0 Take out of the small Table the Collective Root up to

Paushia, which add - - (2)

(2) 39 30 11

Initial Root 1st of Mágha

(2) 30 45 1

Tuesday, Sydereal: Wednesday, Civil.

Here as the Solar month Mágha, falls in January of the year 1825, we refer again to the first Chronological Table for the Dominical Letter of that year, which we find to be B, and as the beginning of the eleven last months of the year cannot fall wider in each month from the date of the 1st Vaisacha in April than 4 days, (\*) referring to the Kalendar in January 1825, we find the Tuesday above found to fall on the 11th January; and Wednesday on the 12th, being the Sydereal and Civil date of the 1st Mágha (Tamul Tye) sought,

The above method is so plain, that it would be useless to multiply examples any further.

#### VI.

As for determining the beginning of the Lunar months of the Siddhanta Chandra Mana by means of Tables only, it was abundantly shewn in the text that such an attempt would be vain; because the Tidhis of which these mouths are composed, depend on no absolute progress of the Sun or Moon in their orbits; but on their apparent relative motion; and because the manner of registering them in the Kalendar is determined by circumstances which have never been attended to by any other known people. (†)

Supposing however, that the reduction of any number of Tidhis into a corresponding one of Solar days, could be effected with precision by a mechanical process, this would be of little advantage in practice; for the Luni-solar style has long since been banished from all civil concerns, and was only retained for the superstitious observances and practices of the Hindus.

The beginning of the Lunar months of the Chandra Mana not susceptible of being determined by the Tables.

<sup>(\*)</sup> Vide Key to the Madhyama Saura Mano, page 15.

<sup>(+)</sup> Vide Key to the Siddhanta Chandra Mana, page 72.

Approximation of the same.

If nevertheless, an approximation of the European date of the Prathama Tidhi of any of the Lunar months of the year were absolutely wanted, it may be obtained by the following easy process.

As whatever be the real deration of the Lunar Synodical month, it is always divided into 30 Tidhis, the last of which is that of the Amavasya or conjunction; and as the common Lunar Civil year is of 354 Bhumi Savan, or natural days (more nearly 354d 22s 1v 12p), we have the following proportion.

As 360 Tidhis, to 354 Solar days, so 30 Tidhis, to  $29\frac{1}{2}$  Solar days.—Hence if to the date of last mean conjunction in the preceding year, given in the fifth column of the second Chronological Table, we add as many times 29 days 30 guddias, as the proposed month is removed of units from the first month in the year, we shall have nearly the Civil date of its end.

#### EXAMPLE.

Examples.

Thus let the same year of the Cali yng 4926 (A. D. 1824) be again proposed, finding by column V, 2d Chronological Table, that the last Amavasya of 4925 fell on Tuesday the 30th March, if to this date we add 29d 30s, the last Amavasya of the Lunar month Chitra will fall nearly on the 29th of April; and the Prathama Tidhi of Vaisacha on the 30th. For the last Amavasya in Vaisacha, it will be  $2 \times 29d 30s = 59$  days, which added as before to the 30th March will fall on the 28th May, and the Prathama Tidhi of the Lunar month Jyaishtá will be the 29th nearly. And lastly, for the end of the Lunar month Mágha, the 11th of the Chandra Mana, we have  $11 \times 29d 30s$ , or 324d 30s, which added to the 30th March 1824, will give the 17th February 1825, the Prathama Tidhi of P'hal'guna, the 12th Lunar month falling very nearly on the 18th February.

If the year which is proposed, be marked with an A, or AC in the third column of the Chronological Table, which indicates a year of 13 Lunar months, or 384 days, (more nearly 383<sup>d</sup> 55<sup>s</sup> 57<sup>v</sup> 48<sup>p</sup>) then the arrangement of the months in the new Chandra Mana, will be disturbed by the intercalation; and as the Table does not inform us which is the intercalated month, the above process will only indicate the numerals, and not the names of the successive months: but it will still approximate the date of their endings: for  $13 \times 29d \ 30s = 383d \ 30s$ , very near the true duration of the intercalated Luni-solar year.

For the European date of the commencement of the Mahommedan Lunar mouths.

There remains now only to shew how the beginnings of the months of the Lunar year of the Mahommedans may be computed by help of the third General Table, for which we have the following subsidiary ore.

How to expound the beginning of the Mahommedan

The Civil months, as has already been said, are alternately of 30 and 29 days, excepting the last, which in common years is of 29, and in intercalary ones, of 30 days.

The figures in a line with Mahorum, indicate the 7 feriæ by which the Mahommedan year may begin, I answering to Sunday, 130

| Numbe<br>of day-<br>in each<br>month | No.               |   | Initial feriæ of months. |   |   |   |    |    |  |
|--------------------------------------|-------------------|---|--------------------------|---|---|---|----|----|--|
| 30                                   | Mahorum           | 1 | 2                        | 3 | 4 | 5 | 16 | 17 |  |
| 29                                   | Sepher            | 3 | 4                        | 5 | 6 | 7 | 1  | 2  |  |
| 30                                   | Rabi-el-Avul -    | 4 | 5.                       | 6 | 7 | 1 | 2  | 3  |  |
| 29                                   | Rabi-el-Aukeer -  | 6 | 7                        | 1 | 2 | 3 | 4  | 5  |  |
| 30                                   | Giumadi-el-Avul - | 7 | 1                        | 2 | 3 | 4 | 5  | 6  |  |
| 29                                   | Giumadi-el-Aukeer | 2 | 3                        | 4 | 5 | 6 | 7  | 1  |  |
| 30                                   | Regeb             | 3 | 4                        | 5 | 6 | 7 | 1  | 2  |  |
| 29                                   | Shahaban          | 5 | 6                        | 7 | 1 | 2 | 3  | 4  |  |
| 30                                   | Rhamadan          | 6 | 7                        | 1 | 2 | 3 | 4  | 5  |  |
| 29                                   | Shawal            | 1 | 2                        | 3 | 4 | 5 | 6  | 7  |  |
| 30                                   | Zoolcada          | 2 | 3                        | 4 | 5 | 6 | 7  | 1  |  |
| 30 29                                | Zooledgee         | 4 | 5                        | 6 | 7 | 1 | 2  | 3  |  |

2 to Monday, and so forth to 7 which answers to Saturday.

The figures which follow underneath in the same perpendicular line, shew the initial feriæ of all the other months in the same year. With regard to the Dominical Letter which is necessary for expounding the European date, it may be either deduced from Table III, or found at once in Table II. As for the application of these data, it will best be shewn by an

#### EXAMPLE.

Let the same year 1824 be proposed, which as we have found at page xv. Example. answers to the 1240th of the Hejira, the Root of which is 5; and whose beginning falls on the 26th August N. S.

Referring to the subsidiary Table, we refer to the column at the top of which 5 is registered, then following it downwards, we find 7, or Saturday, the initial feria of Sepher; then counting 30 days from the 26th August, we find that the said month begins on the 25th September.

For Rabi-el-Avul, the next Root is 1, or Sunday; then counting 29<sup>d</sup> from the 25th September, we find that the said month begins on the 24th of October; and so forth, down to the 12th month Zooledgee.

For this last month, as we find a B. annexed to the 1240th year of the Hejira in the third Chronological Table, we conclude that it is an intercalary one; therefore, after having determined by the preceding process that Zooledgee began on Sunday the 17th July (the Dominical Letter being now B), instead of counting 29 days from that date, we are to take 30, which adding to the 17th July, falls on Tuesday the 16th of August, the initial feria and date of beginning of the 1241st year of the Hejira; as may be seen on referring to the General Table.

The converse of all the preceding methods, is too obvious to need any particular Example; because all that is required is, to refer to the Chronological Tables with the Indian or Mahommedan year proposed. The European year concurring therewith being registered on the same line in its appropriate column, the question is at once reduced to some of those which were proposed in the preceding cases, and therefore needs no further explanation.



FIRST CHRONOLOGICAL TABLE, referring to various Indian Solar styles and years; and shewing the numerals or names, and the Epoch of the commencement of the latter according to European accounts.

| I                | 1           | i.                     | III.            | IV.                     | V.       | •          | VI.                                  | II VH.                  |              | VIII                       |                 | 11             | IX.      | -              | , ,                    | <u>.</u>  | 11                  | XI.                    |              | X-11.       |
|------------------|-------------|------------------------|-----------------|-------------------------|----------|------------|--------------------------------------|-------------------------|--------------|----------------------------|-----------------|----------------|----------|----------------|------------------------|-----------|---------------------|------------------------|--------------|-------------|
|                  | cei         | ·si                    | 후               | the                     | Expir    |            | 8                                    |                         | 1            |                            | 1               |                | ī        | 7              | =                      | 1         | l                   |                        |              | . :         |
| ļ                | o           | z                      | , ,             | m t                     | years    |            | 3                                    | Years of                |              | Years of                   |                 | Tamul civil    | 1        | si l           | ame                    |           | H                   |                        |              | called      |
|                  | ı.          |                        | 2               | ired from<br>Salivahana | Рага     |            | Cycle<br>rithi.                      | the Cycle o             | f            | the Cycle 60 years a       |                 | 113            | S        | 0              | EZ                     | Z.        | H                   |                        |              | ni .        |
| i a              | Letter      | ٠ <u>ξ</u> .           | 2               | pired Saliv             | rama     | _          | 2.5                                  | GO years or             |              | reckoned                   | - 1             |                |          | 등              | Be of                  |           | Rootse              | f begi                 | nings        | years       |
| <u>*</u>         |             | =                      | expired<br>yug. |                         | نه ب     | 2          | 3 4                                  | Vrihaspati,<br>Bengal   | '   <u>.</u> | South of the<br>River Nerm |                 | 8 2            | April N  | March O.       | feriae<br>real y       | April     | of Ta               | imul y                 | cars         |             |
| Christian years. | Dominical   | Dominical Letter       | ) is            | E ex                    | vele.    | pitial da  | ears of the Cycle<br>Grahaparivrithi | reckoning.              | rai          | da.                        | Numerals.       | Initial ferim; | 1.5      | زا ہے ا        | itial feri<br>Sydereal | .5        |                     | sted fr<br>unday,      |              | 1 2         |
|                  | Ē           |                        | Cali            | eers<br>birth           | 11 1     | : <u>.</u> | ears                                 | <b>}</b> }              | Ě            | ]]                         | Ē               | 11.5           | Date     | Date           | Initial<br>Syde        | ate       | )                   | •                      | •            | E A         |
| <u> </u>         | <u> </u>    | 0                      | K K             | ×                       | الم الم  | =          | K                                    | Current year            | s. Ź         | Current yea                | rs Z            | 3.             | <u> </u> | Ä              | Ini<br>S               | ä         | l                   |                        |              | Bengalee    |
|                  | FE          | BA                     | 1501            | 1522                    |          | ep.        |                                      |                         | ١.,          |                            |                 | <b>.</b>       |          | Syd            |                        |           | D.                  |                        | y P.         | 11          |
| 1600             | D           | G                      | 1701            | 1522                    | 776      | H          | 5                                    | Saumya                  | 44           | 11                         | 34              |                | 7        | 27<br>28       |                        | 6         | 1 1 1               | _                      | 5 0          | 2.2         |
| 9                | č           | F                      | 3               | 4                       | 8        | ii         | 6                                    | Sádhárana<br>Viródhacri |              | 11.                        | 36              | 7.7            |          |                | Sat<br>Sur             | 7         | (6)                 | 10<br>95 9             | 6 15<br>7 30 |             |
| 3                | В           | E                      | 4               | 5                       | 9        | 1-1        | 7                                    | Paridhávi               | 140          |                            | 37              |                | 8        | 28             | Mo                     | 7         |                     | 41                     | 8 45         | 11          |
| B 4              | $\Lambda G$ | DC                     | 5               | 6                       | 786      | 10         | 8                                    | Vramádi                 | 47           | i 1 _                      | 38              |                |          | 27             | Tu                     | 6         | 'i_ ` '             |                        | 0 0          | 1010        |
| 5                | F           | В                      | 6               |                         | ]] ]     | 10         | 9                                    | A'nanda                 | 48           |                            |                 |                |          |                | Th                     | 7         | (4)                 | 12 1                   | 1 15         | )           |
| 6                | E           | A                      | 7               |                         |          | 11         | 10                                   | Rác shasa               |              | Parábhava                  |                 |                | 1        |                | Fri                    | 7         | 1                   | 27 4                   |              | 2           |
| D 7              | D           | G<br>FE                | 8               | 1 9                     | 11 "1    | 11         | 11                                   | Anala                   |              | Plavanga                   | 41              | 41             |          | 1 11           | Sat                    | 7         |                     | 43 1                   |              | 3           |
| B 8              | CB<br>A     | D                      | 4710            | <b>.</b>                | !! -;    | 10         | 12                                   | Pingala                 | 51           | 4.3                        | 49              |                | 7        | 1 17           | Sun                    | 6         |                     | 58 4.                  | - 1          | 7 1         |
| 1610             |             | C                      | 1/10            | 2                       |          | 11         | 13                                   | Cálayucta<br>Sidh'arti  | 53           | Saumya<br>  Sádhárana      | 45              |                |          | 1 1            | Tu<br>Wel              | 1         | , , ,               | 14 10<br>2 <b>9</b> 4: | 1            | 1 6         |
| 1                | F           | В                      | 2               |                         |          | 11         | 15                                   | Raudra                  | 54           | 11                         | 1               | 11             | 8        | 1.1            | Th                     | 7         | i ` . '             | 45 18                  |              | 7           |
| B 2              | ED          | AG                     | 3               | 4                       | 8        | 10         | 16                                   | Durmati                 | 55           | 11                         | 46              | !!             |          | 3.5            | Sat                    | 7         | (6)                 | 0 50                   |              | 8           |
| 8                | C           | F.                     | 4               | 5                       |          | 11         | 17                                   | Durdubhi                | 56           | Pramádi                    | 47              | 11             | : 1      |                | Sun                    | 7         | (0)                 | 16 27                  | 1.15         | 9           |
| 4                | В           | E                      | 5               | 6                       | 790      |            | 18                                   | Rudiródgar              |              | A'nanda                    | 18              | <i>! !</i>     | 1 - :    | 11             | Mo                     | 7         | ~ ` ′               | 31 59                  |              | 1020        |
| B 6              | A           | D                      | 6               | 7                       | 11 -1    | 11         | 19                                   | Ractaesla               | 58           | 11                         | 49              | ! I            |          | - 11           | Tu                     | 7         | ` '                 | 17 23                  | . 11         | 1           |
| B 6              | GF<br>E     | CB<br>A                | 8               | 8                       | M −1     | 11         | 20<br>21                             | Cródhana                | 59<br> 60    | 1122                       | 50<br>51        | •              | 1 1      |                | Th  <br>F:i            | 7 7       | (4)<br>(5) 1        | 2 55<br>18 26          | 51           | 2           |
| 8                | Ď           | Ĝ                      | 9               | 1540                    |          | 11         | 22                                   | Cshya<br>Prabhava       | 100          | Cálayucta                  | 52              | Sen            |          | 11             | Sat                    | 7 11      | ` .                 | 33 57                  | - 16         | 4           |
| 9                | č           | F                      | 4720            |                         |          | 11         | 23                                   | Vibhava                 | 2            | Sidh'arti                  | 53              | Mo             |          | - 11           |                        |           | D                   | 19 28                  |              | 5           |
| 1620             | BA          | ED                     | 1               | 2                       | • 4      | 11         | 24                                   | Sucla                   | 3            | Raudra                     | 54              | ]]             |          |                |                        | 7         | (2)                 | 5 0                    | 0            | $\epsilon$  |
| 1                | G           | C                      | 3               | 3                       | 7        | 11         | 25                                   | Pramoda                 | 4            | Durmati                    | 55              |                | 1 }      |                | We                     | 7         |                     | 0 31                   |              | 7           |
| 2                | F           | В                      |                 | 4                       | 8        | 1-1        | 26                                   | Projápati <sup>.</sup>  | 5            | Dundubhi                   | 56              | Fri            | ~        | 11             | ľh                     | 7         |                     | 6 2                    | 11           | 8           |
| 3                | E           | A                      | 4               | 5                       | 9<br>800 | 11         | 27                                   | Angira                  | 10           | Rudii ódga                 | ri [57]<br> 58] | Sat            | , ~ 1    | 1 6            | 1                      | 7   <br>7 | ```                 | 1 33<br>7 5            | - 11         | 1030        |
| B 4              | DC<br>B     | GF<br>E                | 5<br>6          | 6<br>7                  |          | 11         | 28<br>29                             | Srimuc'ha<br>Bhává      | 1 8          | Ractácsha<br>Cródhana      | 59              | 1 1            |          | 11~            | _ 1                    | 7         | (1) %               | -                      | 11           | 1030        |
| 6                | A           | D                      | 7               | 8                       | 11 -1    | 11         | 30                                   | Yuvá                    | g            | Cshya                      | col             | We             |          | - 11           |                        | 7         | (2) 3               |                        | 30           | اِي         |
| 7                | G           | c                      | 8               | 9                       | -1       | 11         | 31                                   | Dhátá                   | 10           | Prabhava                   | 1               | Th             | 8        | 28  1          | Ve] :                  | 7    1    | B(3) 5              | 3 38                   | 45           | 3           |
| B 8              | FE          | BA,                    | S               | 1550                    |          | 14         | 5 <b>2</b>                           | Iswara                  | 11           | Vibhava                    | 2               |                |          |                |                        | 7         |                     | 9 10                   | 6            | 4           |
| 9                | D           | G                      | 1730            | 1                       |          | 11         | 33                                   | Bahudanya               | 12           | Sucla                      | 3               | Mo             |          |                |                        | 7         | (6) 2               | :                      | 15           | 5           |
| 1630             | C           | F                      | 1               | 2                       | 1 1      | 11         | 34                                   | Pramát'hi               | 13           | Pramoda                    | 4)              |                |          | 8 S            |                        | 7   <br>7 | (0) 40<br>3°(1) 5;  | 0 1 <b>2</b><br>5 43   | 30           | 6<br>7      |
| B 2              | B           | E                      | . 9             | 3                       | 1 1      | 11         | 35                                   | Vicrama                 | 1.4<br>15    | Prajápati                  | 6               |                | _        |                | Ve 7                   | 1.        | (3) 11              |                        | d            | sl          |
| 3                | AG<br>F     | B                      | 3               | 4<br>5                  | 1 ~1     |            | 36<br>37                             | Brisya<br>Chitrab hanu  | 16           | Angira<br>Srimuc'ha        | 7               |                |          | 8 T            |                        | -         | (4) 20              |                        | 15           | 9           |
| 4                | - 1         | A                      | 5               | 6                       |          | 11         | 38                                   | Súbhánu                 | 17           | Bhává                      | 8               | Sat            | 8 2      | 8 F            |                        | 11 -      | (5) 49              |                        | 11           | 1046        |
| 5                | D           | G                      | 6               | 7                       | 1        | 11         | 39                                   | Tárana                  |              | Yuvà                       |                 | Sun            |          | 8  S:          |                        |           | <sup>3</sup> (6) 57 |                        |              | 11          |
|                  | CB          | FE                     | 7               | 8                       | 2        | 11         | 1                                    | Párthiva                |              | Dhátá                      | 10              | 1              |          | 8  N           |                        |           | (1) 13              | 3 20                   | C            | 2!<br>3     |
| 7                |             | D                      | 8               |                         | 3        | 11         | 41                                   | Vyaya                   | 20           | Iswara<br>Bahudanya        | 11<br>12        | Th             | 8 2      | 8   T<br>8   W |                        |           | (2) 28<br>(3) 44    |                        |              | 4           |
| 8                | G           | C                      |                 | 1560                    | 4        |            |                                      | Sarvajit<br>Sarvadhári  | 20           | Banudanya<br>Pramát'hi     | 13              | Fri            | 8 2      |                |                        |           | (3) 44              | 53                     | 45           | 5           |
| Ω<br>1640        | F           | В                      | 4740            | 1                       | 6        |            |                                      |                         |              | Vicrama                    | 1144            | - 1            | 2        | g∐Sa           | t   7                  |           | (6) 15              |                        | oil          | 61          |
| 1040             | c           | . F                    | 1<br>2          | 3                       | 7 1      | ii∥        |                                      | Vicrita                 | 24           | Brisya                     | 15              |                | 8   2:   | 3 ไร่น         | n <sup>1</sup> 7       | 1         | (0) 30              | 56                     | 15           | 7           |
| 2                | В           | E                      | 3               | 4                       | 8 1      | 11[        | 46                                   | C'hara                  | 25           | Chitrab/hanu               |                 | fu             | 8 2      | 3! M           | 0 7                    | B         | (1) 40              |                        |              | 8           |
| 3                | A           | $\mathbf{D}^{\dagger}$ | 4               | 5                       | 9 1      | 11         |                                      | Nandana                 | 26           | Súbhánu                    | 17              |                | 29       | 9   <b>V</b>   | e i 8                  | - 1       |                     | 58                     | 45]          | 9           |
|                  | GF          | CB                     | 5               | 6                       | 820      | 11         |                                      | . 55                    |              | Tárana<br>Párthíva         | 18              | Sat            | 28       |                |                        |           | (4) 17              |                        | 0 10         |             |
| . 5              | E           | A                      | 6               | 7                       | 1 1      |            | 49                                   | <i>J</i> 7 ∞            |              | Partniva<br>Vyaya          | 2018            | sun   i        | 8 2      |                | ri   7                 | IR        | (5) 53<br>(6) 48    |                        |              | ٳٛ          |
| 6                | D           | Gi                     | 7               | 8                       |          |            | 50                                   | Manmat na<br>Durmuch'ha | 5011         | Sarvajit                   | 21              | '              | 2        |                | 0 8                    |           | (1) 4               | 3 4                    | 15           | 4           |
| B 8              | C<br>BA     | F                      | 8               | 9<br>1570               | 41       |            | 52                                   | Hemalamya               | 31           | Sarvadhári                 | 22              | 1              | 2        | 3'  T∙         | u   7                  | 4         | (2) 19              | 35                     | 0            | 1 2 3 4 5 6 |
| 9                | G           |                        | 4750            | 1                       | 5 1      |            | 53                                   | Vilamva                 |              | Viródhi                    | 23              | Th             | 8 28     |                | e 7                    | 1         | (3) 35              | 6                      | 5            | 5]          |
| 1650             | F           | B                      | 1               | 2                       |          |            |                                      | Vicari                  | 33           | Vicrita.                   | 2111            | Fri  8         | 28       | TI             | 1 7                    | ΙB        | (4) 50              | 37 3                   | 301          | 54          |
|                  | - 1         |                        |                 | _                       |          |            |                                      |                         |              |                            |                 |                |          |                |                        |           |                     | _                      |              |             |

| AAII             |                                                  |                                |                                |                                       |                                              | 1                                                                              |                | VIII                                                                                       | 11             |                  | x.                                      | 11                         | K. 1                                  | X                                      | I.                                       | II X I                | 1. 1     |
|------------------|--------------------------------------------------|--------------------------------|--------------------------------|---------------------------------------|----------------------------------------------|--------------------------------------------------------------------------------|----------------|--------------------------------------------------------------------------------------------|----------------|------------------|-----------------------------------------|----------------------------|---------------------------------------|----------------------------------------|------------------------------------------|-----------------------|----------|
| I_I.             |                                                  | 111.                           | IV.                            | <u>v.</u>                             | VI.                                          | VII.                                                                           |                | VIII                                                                                       | -:             |                  | <u> </u>                                | · }                        |                                       |                                        |                                          | .][                   | -        |
| Christian years. | Dominical Letter O. S.<br>Dominical Letter N. S. | Tears expired of the Cali yug. | xpired from the of Salivabana. | Vers of the Cycle.  Intial date land. | Years of the Cycle of 90<br>Grahaparivrithi. | Years of<br>the Cycle of<br>60 years or<br>Vrihaspati,<br>Bengal<br>rockoning. | Numerals.      | Years of<br>the Cycle of<br>60 years as<br>reckoned<br>South of the<br>River Nerma-<br>da. | Numerals.      |                  | Date in April N. S. Date in March O. S. | 4                          |                                       | of Tam                                 | beginning<br>ul years<br>ed from<br>day. | Bengalee years called |          |
|                  |                                                  | <u>x</u>                       |                                | Sep.                                  | <u> </u>                                     | <u>-</u>                                                                       |                |                                                                                            |                | i                | $- \bar{s} $                            | yd.                        |                                       |                                        | 6 8 4                                    |                       | _        |
| 1651<br>B 2      |                                                  | 4752<br>3                      | 4                              | 827 12<br>8 11<br>9 11                | 55<br>56<br>57                               | Sarvar <b>i</b><br>Plava<br>Subhacrit                                          | 34<br>35<br>36 | C'hara<br> Nandana<br> Vijya                                                               | 25<br>26<br>27 | Γu               |                                         | 9 Sa<br>8 Su<br>8 M        | ın 7                                  | 11 \                                   |                                          | o]]                   | 8<br>9   |
| 3 4              |                                                  | 5                              | 1                              | 830 11                                | 58                                           | Sóbhana                                                                        | 37             | Jya                                                                                        | 28             | We               | 8 2                                     | $\mathbf{s} _{\mathbf{T}}$ | u   7                                 | B(2)                                   | 52 42 3                                  | 0 10                  | 60       |
| 5                |                                                  | 6                              |                                | 1 12<br>2 11                          | 59<br>60                                     | Crádhi<br>Viswávasů                                                            | 33             | Manmat'ha<br>Durmuch'ha                                                                    | 29             | 1                |                                         | 28 F                       |                                       | (4)                                    | 8 13 4<br>23 45                          | 5<br>0                | 2        |
| B 6              | 1 1                                              | 8                              | 9                              | 3 11                                  | 61                                           | Parábhava                                                                      | 40             | Hemalamva                                                                                  | 31             | Sun              | 8                                       | 28 3                       | at   7                                | (6)                                    | 39 16 1                                  | 5                     | 3        |
| 8 9              | , ,                                              | 47760                          | 1                              | 4 11<br>5 12                          | 62                                           | Plavanga<br>Cílaca                                                             | 41 42          | Vilamva<br>Vicari                                                                          | 32<br>33       | Mo               |                                         | 28] S<br>29  T             |                                       | 11 "                                   | 54 47 3<br>10 18 4                       | 1.5                   | 5        |
| 1660             | 1                                                | 4760                           | 2                              | 6 11                                  | 61                                           | Saumya                                                                         | 43             | Sarvari                                                                                    | 134            | il               |                                         | 28 V                       | Ve 7                                  | (3)                                    | 25 50                                    | 0                     | 6 1<br>7 |
| 1 2              | 1 - 1 -                                          | 9                              | 3 4                            | 7 11<br>8 11                          |                                              | Sádhárana<br>Viródhacrit                                                       | 44 45          | Plava<br>  Subhacrit                                                                       | 35<br>36       | Fri<br>Sat       | 8                                       |                            | `h   7<br>'ii   7                     | 11_ ` ′                                |                                          | 1.5<br>30             | 8        |
| 3                | D G                                              | 4                              | 5                              | 9 12                                  | 67                                           | Paridhávi                                                                      | 46             | Sóbhana                                                                                    | 37             | <b>'</b> {{}     | Į į                                     | 29  5                      | uu   8                                |                                        |                                          | 45<br>0. 1            | 9        |
| B 4              | 1                                                | 13                             | 6 6<br>6 7                     | 1 1 -                                 | 31                                           | Pramádi<br>A'nanda                                                             | 47             | Crádhi<br>Viswávasů                                                                        | 38             |                  |                                         | - 11                       | /lo   7                               |                                        | 27 55<br>43 26                           | 15                    | 1        |
| 1 6              | GC                                               | ₩,                             | 7 8                            | 2 1                                   | 70                                           | Rac'shasa                                                                      | 49             | Parábhava                                                                                  | 40             |                  | 8                                       | 11                         | We 7                                  | 11- 1                                  | •                                        | 30  <br>45            | 3        |
| B 8              | F B                                              |                                | 8  9<br>9 1590                 | 1 - 1                                 |                                              | Anala<br>Pingala                                                               | 50<br>51       | Plavanga<br>Cílaca                                                                         | 41             | i    <br>2,  Sui |                                         |                            | Fri   8<br>Sat   7                    | 3 j (5)<br>7 j (6)                     | 30 O                                     | O                     | 4        |
| 9                | CF                                               | 477                            | 0 1                            | 5,1                                   | 18                                           | Cálayueta                                                                      | 52             | Siumya                                                                                     | 4              |                  | 8                                       |                            |                                       | 7   B (0)<br>B   (2)                   |                                          | 15<br>30              | 5!<br>61 |
| 1670             | B E                                              |                                | 1   2   3   3                  |                                       |                                              | Sidh'arti<br>Raudra                                                            | 53<br>54       | liSádhárana<br>Vir <b>ó</b> dhacri                                                         | t 4            | 11               |                                         |                            |                                       | $\begin{bmatrix} 2 \\ 3 \end{bmatrix}$ |                                          | 45                    | 7        |
| В                | 2 GF CI                                          | 3                              | 1                              | 8 1                                   | 1 76                                         | Durmati (* Durm. Dur Dundubhi                                                  |                | Paridhávi                                                                                  | 1              | 6 Fr             | i 8                                     | 28                         | Гһ                                    | 7 (4)                                  | 32 5                                     | 0                     | 8        |
|                  | 3 E À                                            | <b>.</b>                       | 4                              | 5 9 1                                 | 1 77                                         | Rudiródga<br>Rudiródga                                                         | i  57          | Pramádi                                                                                    | 4              | 7   Sa           | t   8                                   | 58                         | Fri                                   | 7   B (5)                              | 47 36                                    | 15                    | 9        |
| j.               | 4 D (                                            | }                              | 5                              | <b>6</b> 850 1                        | 1 78                                         | Ractársna                                                                      | 58<br>58       | A'nanda                                                                                    | 1              | 5                | -                                       | 29                         | Sun                                   | 8 (o)                                  | •                                        | _ II                  | 1080     |
| -                | 5 C I                                            | 7                              | 6                              | 7 1 1                                 | 2 79                                         | # C 10000000                                                                   | 59<br>59       | Rac'shasa                                                                                  | 1              | ٤                | ĺ                                       | 1 1                        | Мо                                    | 11 -                                   |                                          | 45                    | 1        |
| B                | 6 BAE                                            | a                              | 7                              | 8 2 1                                 | 1 80                                         | i t Canya                                                                      | 60<br>60       | \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \                                                      | 1              | oll W            | - }                                     | 1 11                       | Tue                                   | H '                                    | 34 10                                    | O                     | 2        |
|                  | 7 G                                              | c                              | -[                             | 9 3                                   | 1                                            | II & CIADNATO                                                                  | i              | Pingala                                                                                    | - (            |                  | h   8                                   | 1 !!                       | · · · · · · · · · · · · · · · · · · · | 7   B (3)                              |                                          |                       | 3        |
|                  | 8 F                                              | В∥                             | 9 160                          | 11 1                                  | 11                                           | II ( A 1 DD 1 A ST                                                             | 2              | {   Cálayucta                                                                              | - t            | 2                |                                         | 1 ()                       | . t                                   | 8 (5)                                  |                                          | 30                    | 5        |
| 1                | ) [                                              | A 47                           | - 1                            | 1 5                                   | 11                                           | [ (Sucia                                                                       | 3 3            | }  Sidh'arti                                                                               | - 1            | 3                |                                         | 1 11                       | Sat                                   | 8 (6)                                  |                                          | 11                    | 6        |
| 168              | 80 DC G                                          | t(                             | -1                             | 2 6                                   | - 11                                         | Pramoda                                                                        | 4              | Raudra                                                                                     | - 1            | 5 T              | •                                       | 28                         | 1                                     | 11 1                                   | 36 15                                    |                       | 7        |
|                  | 1 1                                              | E                              | 2                              | 3 7 8                                 | 85                                           | Prajápati                                                                      | 5 5            | Durmati Dundubhi                                                                           | 1              | 66               | u   8                                   | 1 1                        | Mo<br>We                              | 8 3                                    | ) 51 46<br>) 7 17                        |                       | 8        |
|                  | 2 A G                                            | D                              | 3 4                            | 1                                     | 12 86<br>12 87                               | Angira                                                                         | 6 6            | Rudiródg                                                                                   | 1              | - 11             |                                         | 29                         | ١ .                                   | 11 \                                   | ) 22 48                                  |                       | 9        |
| -                | 1 1                                              | - 11                           | Ì                              | - H                                   | 1                                            | Srimu/cha                                                                      | 17             | 31                                                                                         | 1              | 58 S             |                                         | 28                         | ; 1                                   |                                        | 38 20                                    | ,                     | 1090     |
| B                | 1 _ 1                                            | - 8                            | 5                              | 6 860                                 | 1                                            |                                                                                | 8              | Ractácsha<br>Cródhana                                                                      | )              | 59 S             | - 1                                     | 28                         | 1 1                                   |                                        | 53 51                                    | - 1                   | 1 1      |
|                  | 5 D<br>6 C                                       | G  <br>F                       | 6 7                            |                                       | 11 8<br>12 9                                 |                                                                                | 10             | 11                                                                                         |                | 60               | un j                                    |                            | Mo                                    | 8 (1                                   |                                          | 2 30                  | 2        |
| 1                | 7 B                                              | · E                            | 8                              | g   3                                 |                                              | cle<br>1 Iswara                                                                | 11             | Prabhava                                                                                   | }              | <b>1</b>         | Ì                                       | 29                         | Tu                                    | 8 (9                                   | 24 5                                     | 3 45                  |          |
| В                | 8 AG                                             |                                | 9 <sup>1</sup> 16              | 310 4                                 | 1 4                                          | 2 Bahudany                                                                     | a   12         | Vibhava                                                                                    | į              |                  |                                         | 8 23                       | We<br>Th                              | 7 B (4                                 | () 40 2<br>() 55 5                       | 5 (·<br>6 15          | 5        |
| 1                | 9 F<br>690 E                                     | B   4                          | 1790                           | 2 6                                   | 12                                           | 3 Pramát'hi 4 Vicrama                                                          | 13             | 11                                                                                         | Į              | 4                | TI I                                    | 8 <b>  ୬</b> ୫ <br>ଅନ୍ତ    |                                       | 8 (                                    | 5) 11 2                                  | 7 30                  | 6        |
| E                | 1 D                                              | G<br>FE                        | 2                              |                                       | 7 12                                         | 5 Brisya<br>6 Chitrab'h                                                        | 12<br>10 16    | i   Prajápati                                                                              | j              | 5  <br>6  1      | r,                                      | 25<br>  28                 | Sun                                   |                                        | 1) 42 3                                  | 0 0                   | 8        |
| 1                | 3 A                                              | D.                             | 4                              | 5                                     | 9 11                                         | 7 Súbhána                                                                      | 1 17           | Srimuc'h                                                                                   | . ·            | 7                |                                         | 8 28                       | Tu                                    | 7 B (                                  | 9) KR                                    | 1 15                  | 11:00    |
| 1                | 4 G<br>5 F                                       | B                              | 5  <br>6                       | 7                                     | 0 12<br>1 12                                 | 8 Tárana<br>9 Párthiva                                                         | 18             |                                                                                            |                | 8                |                                         | 29<br>29                   | Th<br>Fri                             |                                        | 5) 29                                    | 3 45                  | 1        |
| 1                | B 6 ED                                           | AG                             | . 7                            | 8                                     | 2 11                                         | 10 Vyaya                                                                       | 21             | Dháta.                                                                                     |                | 10               | Sun                                     | 8 28                       | Sat                                   | 7 B                                    | 6) 41 3                                  | 5 0<br>6 15           | 11 .     |
| 1                | 7 C<br>8 B                                       |                                |                                | 1630<br>0                             | 4 12                                         | 11   Sarvajit<br>12   Sarvadhá                                                 | ri 2           |                                                                                            | ya             | 11               |                                         | 29                         | Mo<br>Tu                              | 13 1                                   | 2) 15 3                                  | 7 30                  | 4        |
| 1                | 9 A<br>1700 G                                    |                                | 4800                           | 1 2                                   | 5 12<br>6 12                                 | 13 Viródhi<br>14 Vicrita                                                       | 1              | 3 Pramát'l<br>1 Vicrama                                                                    | ìi             | 12               |                                         | 9 29                       | We                                    |                                        | 3) 31<br>4) 46 4                         | 8 45<br>0 0           | 11 .     |
| . 1              | 1700101                                          |                                |                                |                                       |                                              | -3 H FICTOR                                                                    | 1 2            | * [[VICTAINA                                                                               |                | 12.41(           | 2 12 1                                  | 3 128                      | 10                                    |                                        | hu the Iv                                |                       |          |

<sup>(\*)</sup> The upper names, printed in italies, are those by the Surrich Middhanta; the lower ones, printed in roman, are those by the Jyantistava.

| I.               | 11.              | 11 1             | III:            | ìV.                | v.                    |             | VI.                               | V11.                       |          | VIII.                              |                 |                            | IX.      | 1        | X                            | •                                      |            | X.                | ١. ه     |                 | XII.   |
|------------------|------------------|------------------|-----------------|--------------------|-----------------------|-------------|-----------------------------------|----------------------------|----------|------------------------------------|-----------------|----------------------------|----------|----------|------------------------------|----------------------------------------|------------|-------------------|----------|-----------------|--------|
|                  |                  | —   -<br>å    .  | e e             | the .              | Expire                |             | 8                                 |                            |          |                                    |                 | 15 T                       |          | •        | Tamul<br>N. S.               | 1                                      |            |                   |          |                 | called |
|                  | - 1              | . !!             | i i             | m t                | years<br>the Æ        |             | jo e                              | Years of                   |          | Years of<br>the Cycle of           |                 | Famul civil                | 'n.      | øi       | EZ                           | x.                                     |            |                   |          |                 | 2      |
| ١. ١             | 5   3            | 5 1              | 5               | 5 8                | Paras                 |             | cars of the Cycle Grahaparivithi. | the Cycle of               | - {      | 60 years as                        | 1               | l'anu.                     | ż        | March O. | Cars                         | z                                      |            |                   | •        | •               | 5      |
| 876              | <b>#</b>         | ž    ž           | red             | pired<br>Suliv     | rama.                 | _           | 5                                 | 69 years or<br>Vrihaspati, | ĺ        | reckoned<br>South of the           | Ιİ              |                            | pril N.  | ırc      | 8 S                          | prii N.                                |            | Is of be<br>Taint |          |                 | years  |
| 5                | = 1              | =                | expired<br>yug. | of S               | 3 =                   |             | 를릴                                | Bengal                     | ž        | River Nerma-                       | ž               | 1 1                        | (<       | E        | tind ferir<br>Sydereal       | 4                                      |            | unter             | l froz   |                 | 9      |
| ian              | nic .            |                  | 0 h             | اعا                | Cycle of              | 2           | ag ag                             | reckoning.                 | era      | da.                                | era             | itial ferr                 | in       | i.       | i e                          | .5                                     |            | Sund              | ay.      |                 | Sen,   |
| Christian years. | Dominical Letter | Dominical Letter | Call            | Sirth<br>Sirth     | Vears<br>the C        | tutusi dini |                                   | Cuesant mana               | E .      | Current years                      | Num             | Luitial ferrar, account N. | Dute in  | Date     | Initial ferine<br>Sydereal y | Date                                   | -          |                   |          |                 | Ben X  |
| 2                | <u>a -</u>       | 으                | <del>&gt;</del> | <u> </u>           |                       | 11          | <u>-</u> -!                       | Current years.             | -        | Ourrent years                      | -               | 1                          | <u> </u> | Ĉiv      |                              | =                                      |            | . G.              | v.       | P,              |        |
| 1701             | E                | B                | 1809            | 1623               | 877                   | p.  <br>12  | 15                                | C'hara                     | 25       | Brisya                             | 15              | 1                          |          |          | Sat                          | 9                                      | : 1        | 3) 2              |          |                 | 1107   |
| 9                | D °              | A                | 3               |                    |                       | 13          | 16                                | Nandana                    | 26.      | Chitrab/hanu                       | 16              | 1                          |          | 50       | Sun                          | 9                                      | ) (        | )) 17             |          |                 | 8      |
| 3                | C                | G                | 4               | 1                  |                       | 13          | 17                                | Vijya                      | 27       | Súbhánu                            | 17              | Ta                         | 10       | 30       | Mo                           | 9                                      |            | 1) 33             |          |                 | 9      |
| B 4              |                  | FE               | 5               |                    | 11                    |             | 18                                | Jya                        | 28       | Tárana                             | 18              | We                         | 9        | 29<br>29 | Tu<br>Th                     | 8                                      | B (9       |                   |          |                 | 1110   |
| 5                | G                | D                | 9               |                    |                       | 12          | 19<br>20                          | Manmat'ha<br>Durmuch'ha    | 20       | Párthiva<br>Vyava                  | 19              |                            |          | 29       | Fri                          | 9                                      | 1          | -                 | 47       | - 1             | 2      |
| 6                | F                | C<br>B           | 7               |                    |                       | 13          | 21                                | Hemalamva                  | 31       | Sarvajit                           | 21              | Sun                        | 10       |          | Sat                          | •9                                     | ice        | •                 |          | - 1             | 3      |
| B 8              | 100              | ΛĞ               |                 | 1630               | 11 1                  | 12          | 22                                | Vilamya                    | 32       | Sarvadhári                         | 22              | Mo                         | 9        | 29       | Sun                          | 8                                      | B (0       |                   |          | O               | 4      |
| 15 6             | 1                | F                | 4810            | ,                  | 5                     | 12          | 23                                | Vicari                     | 33       | Viródhi                            | 23              |                            |          | 29       | Tu                           | 9                                      | (9         | 7                 |          | - 1             | 5      |
| 1710             | 1 . 1            | E                |                 | 1 2                |                       | 13          | 24                                | Sarvari                    | 1        | Vicrita                            | 24              | J                          | 10       | 29       | We<br> Th                    | 9                                      | (3         | ·                 | _        | 30<br>45        | 6      |
| 1                | G                | D                | 1               | 2 3                | f 1                   | 13          | 25                                | Plava                      | 1 -      | C'hara<br>Nandana                  | 25<br>26        |                            |          | 29       | Fri                          | 1 . 1                                  | B (5       | ,                 |          | 0               | 8      |
| 13 %             | 1 [              | CB !             | •               | 3 4<br>4 5         | 11                    | 12<br>13    | 26                                | Subhacrit<br>Sóbhana       | 36<br>37 | 11                                 | 27              | Jac                        | "        | 29       | Sun                          | 9                                      |            |                   |          | - 1             | 9      |
| 1 3              | 1                | A<br>G           | I               | 5 6                | 11                    |             | 28                                | Crádhi                     |          | Jva                                | 28              |                            | l        | 29       | Mo                           | 9                                      | (i         | ý <b>2</b> 3      | 57       | 30              | 1120   |
| 4                | 1 !              | F                | •               | 5 7                |                       | 13          | 29                                | Viswavasù                  |          | Manmat'ha                          | 29              | We                         |          |          | Tu                           | 9                                      | (9         | _                 | _        | 45              | 1      |
| В                | 1.0              | ED               |                 | 7 8                |                       | , ,         | 30                                | Parábhava                  | 1        | Durmuch'ha                         |                 | Th                         | 9        | 29       | We                           | 8                                      | B (3       | ·                 | 0<br>31  | 15              | 2      |
|                  |                  | C                |                 | 8 9                | 11                    | 13          | 31                                | Plavanga                   | 41       | U = -                              | 31              | il                         |          | 29<br>29 | Fri<br>Sat                   | 9                                      | (5         | ·                 | 2        | 30              | 4      |
| 1 8              |                  | В                |                 | 9 16 49            |                       |             | 32                                | Cílaca                     | 42       | 11 -                               | 33              | Mo                         | 10       |          | Sun                          | 1 1                                    | 1 6        | ,                 | 33       | 45              | 5      |
| 9                |                  |                  | 482             |                    |                       | : - +       | 33                                | Saumya<br>Sádhárana        | 44       | 11.                                |                 | Tu                         |          | 29       | Mo                           | , ,                                    | B (1       | ,                 | 5        | 0               | 6      |
|                  | CB               | GF<br>E          | 1 .             | 1 9                | 11 .                  | 13          | 35                                | Viródhacrit                | 1        | 81 ° '                             | 35              | 11                         |          | 29       | We                           | 9                                      | (3         | ,                 |          | 15              | 7      |
|                  | A. G             | D                |                 | 3                  | . 11                  | 1 :         | 36                                | Paridhávi                  | 46       | Subhacrit                          | 36              |                            | Ì.,      | 29       | Th                           | 9                                      | (4         | ·                 | 7<br>38  | 30<br>45        | 8      |
|                  | F.               | č                | 1 :             |                    | 5 9                   | 13          | 37                                | Pramádi                    | 17       | 19                                 | 37              | 3 L =                      | 1        |          | Fri<br>Sat                   | 9<br>8                                 | B (5       | ,                 |          | 0               | 1130   |
| В                | ED               | BA               | i<br>ii .       | 5 (                | 5 <mark>  </mark> 900 |             |                                   | A'nanda                    | 18       | 11                                 | $\frac{38}{39}$ | 11                         | y        | 29       | Mo                           | 9                                      | l a        | ′                 |          | 15              | 1      |
|                  | 5 C              | G                |                 | 6                  | 7 1                   |             | 11 1                              | Rac'shasa                  | 4!<br>50 | Has and                            |                 | We                         | 10       |          | Tu                           | 9                                      | (2         | •                 | 12       | 30              | 2      |
| ı                | 5 B              | F                | 3 1             | * I                | 9 3                   | 13<br>13    | 40                                | Anala<br>Pingala           |          | Plavanga                           | 41              | Th                         | 10       | 30       | We                           | 9                                      | B (3       |                   | 43       | 45              | 3      |
|                  | 7 A S            | DC               | 16              | 8 : 1650<br>9 1650 |                       | 12          | 49                                | Cálayucta                  |          | Cílaca                             | 12              | 1                          | i        | 29       | Fri                          | 9                                      | (5         | ,                 | 15<br>46 | 0               | 4      |
| 1                | 9 E              | B                | 483             | 7                  | 1 6                   | 13          | 43                                | Sidh'arti                  | 53       |                                    | 43              | Mo                         | 1.0      | 29       | Sat<br>Sun                   | 9                                      | (6         |                   | _        | 15<br>30        | 6      |
| 173              |                  | Ā                | 1               |                    | 2 6                   |             | 44                                | Raudra                     | 54       | 11                                 | 45              | 11 .                       |          |          | Mo                           | 9                                      | B (1       | ,                 |          | 45              | 7      |
| 1                | 1 C              | G                | 11              |                    | 3 7                   | 1 1         | 45                                | Durmati                    | 55       | tles and                           | 46              | ':                         |          |          | We                           | 9                                      | (3         | , ,               | 20       | o!              | S      |
| 1                | 2 BA             | FE               |                 | ~ [                | 4 8                   | 13<br>13    | 46                                | Dundubhi<br>Rudiródgar     | 157      | Pramadi.                           | 47              |                            |          | 29       | Th                           | 9                                      | (4         | •                 | 51       | 15              | 5      |
| -                | 3 G              | D                | ·               | -1                 |                       | 13          |                                   | Ractácsha                  | 158      | A nanda                            | 18              | Sat                        | 10       | 30       | Fri                          | $\begin{vmatrix} 9 \\ 9 \end{vmatrix}$ | D (5       |                   |          | 30<br>45        | 1140   |
|                  | 4 F<br>5 E       | C<br>B           |                 | 5<br>6             | 7 1                   | 13          | 49                                | Cródhana                   |          | Rac'shasa                          | 19              | !!                         | 10       | 20       | Mo                           |                                        | (1         | ) 49<br>) 5       | 25       | 0               | 2      |
| В                | 6 DC             |                  |                 |                    | 8 9                   | 13.         | 50                                | Cshya                      | . 1      | Anala                              | 50              |                            |          | 29       | Tu                           | 9                                      | (2         |                   |          | 15              | 3      |
| }_               | 7 B              | F                | 11              | 8                  | 9 3                   | 3 13        | 51                                | Prabhava (*                |          | Pingala<br>  Cálayusta             | 52              | Th                         | 10       | 30       | We                           | 9                                      | (3         |                   | 27       | 30              | 4      |
| Ì                | 8 A              | E                |                 | 9 166              | - 11 -                | 13<br>13    | 52<br>53                          | Vibhava.                   |          | Sidh'arti                          | 53              |                            | 10       | 50       | Th                           |                                        | B (4       |                   |          |                 | 5      |
| 1                | 9 G              | D                | 48              |                    | 11 5                  | 13          | 54                                | Pramoda                    | 4        | Raudra                             | 51              |                            |          |          | Sat<br>Sun                   | 9                                      | (6         |                   |          | 0               | 6<br>7 |
| 174              | OFE              | 1 .              |                 | ,                  | 2 7                   | 13          | .55                               | Prajápati                  | 5        | Durmati                            | 55              | Го                         |          |          |                              | 9                                      | (0         |                   |          | 30 <sup>1</sup> | ś      |
|                  | 1  D<br>2  C     | A<br>G           | 1               |                    | 4 8                   | 3 13        | 56                                | Angira                     | 6        | Dandabhi<br>Rudiródgari            | 56              | We                         | 10       | 30       | Tu                           | 3                                      | B (2       |                   | 3        | 45              | 9      |
| Ì                | 3 B              | F                |                 | ~                  | 5 9                   | 13          |                                   | Srimuc'ha                  | 1 %      | Ractácsha                          | 58              |                            | . ,      | 29       | Th                           | 9                                      | (4         | •                 | 35       | 0               | 1150   |
| B                | 4 AG             | ED               | 佳               | 5                  |                       | 13          | 58<br>59                          | Bhává<br>Yuvá              | 9        | Cródhana                           | 59              |                            | ا        |          | Fri                          | 9                                      | (5         | <b>)</b> 25       |          | 15              | 11     |
|                  | 5 F              | C                | 11              | ~I .               |                       | 13<br>13    | 11                                | Dhátá                      | 110      | Cshya                              |                 | Sun                        | 10       | 30       | Sat                          | 9                                      | (6<br>P (6 |                   | 37       | 30              | 7.2    |
|                  | 6 E              | • .              | 11              | • ;                | 9 3                   | 13          |                                   | Iswara                     | 111      | Prabhava(†)                        | 2               | MO                         | 101      |          | Sun<br>Tu                    | 9                                      | B (0       | ) 56<br>) 11      | 40<br>40 | 45<br>0         | 4      |
| l<br>IB          | 7 D<br>8 CB      |                  |                 | 9 167              | o   4                 | 13          | 62                                | Bahudanya                  | 12       | Vibhava<br>Sucla                   | 3               |                            |          | 29       | We                           |                                        | (3         | 27                | 11       | 15              | 5      |
|                  | 9 A              |                  | 48              | 50,                | 1]] /3                | 13          |                                   | Pramát'hi<br>Vicrama       | 14       | Pramoda                            |                 | Fri                        |          |          |                              |                                        | (4         | $\frac{7}{42}$    | 42       | 30              | 6      |
| ,17 <i>5</i>     | o G              |                  |                 | 1                  | 2 6                   | 113         | 61                                |                            | •        |                                    |                 |                            |          |          |                              |                                        |            |                   |          |                 |        |
| •                |                  | <u></u>          |                 | -                  |                       | (*)         | Begi                              | nning of the 83d           | Cyc      | ie or Jupiter, S<br>do Tellines so | COIN<br>THE FE  | m Sia<br>it.               | uuil     | ii Lila  |                              |                                        |            |                   |          |                 |        |
|                  |                  |                  |                 |                    |                       | (†          | ) Begi                            | nning of the 52d           | UŞ       | cic, rempeate                      | ~~ u            | ***                        |          |          |                              |                                        |            |                   |          |                 |        |
|                  |                  |                  |                 |                    |                       |             |                                   |                            |          |                                    |                 |                            |          |          |                              |                                        |            |                   |          |                 |        |

| I.               | I                                           | I. A             | III.            | IV.                                            | V.                                     | VI               | VII.                      |              | VIII.                               | - 1      | IX              | •_    | X.                             | !!      |         | XI.        |               | 11         | XII.             |
|------------------|---------------------------------------------|------------------|-----------------|------------------------------------------------|----------------------------------------|------------------|---------------------------|--------------|-------------------------------------|----------|-----------------|-------|--------------------------------|---------|---------|------------|---------------|------------|------------------|
|                  | u.                                          | si l             | the             | the .                                          | Expired                                | 3,               |                           |              | 1                                   | _        | civil           | _     | 12.0                           |         |         |            |               |            | 8                |
|                  | 0                                           | z                | of              | ears expired from that the that of Salivakana. | years of<br>the Æra                    | je .             | Years of                  |              | Years of the Cycle of               |          | ılci            | · ic  | Tauud<br>N. S                  | اند     |         |            |               |            | called           |
|                  |                                             | - I              |                 | fie<br>/ahz                                    | Parasu-                                | Cycle<br>vrithi. | the Cycle of              | Í            | 60 years as                         |          | Famul 6<br>S.   | z     |                                | Z       |         |            | •             |            | e 4              |
| g Z              | =                                           | ē !              |                 | P in                                           | ramu.                                  | i C              | Vrihaspati,               |              | reckoned<br>South of the            |          |                 |       | 9 5                            |         | Roots o |            |               |            | N N              |
| Christian years. | Dominical Letter                            | Daminical Letter | expired<br>yug. | id a                                           | ا الله                                 | s of the Cycle   | Bengal                    | <u> </u>     | River Nerma                         | <u>.</u> | Initial ferian; | April | E .                            | hril    | of Ta   |            | year.<br>from |            |                  |
| tia              | iii                                         | Ξ                |                 | th C                                           | ars of<br>Cycle.<br>Indidate           | - E :* 1         | reckoning.                | era          | d.ı.                                | rrals.   | Count           | =     |                                | ≘ ¦     |         | abos       |               | II         | ا. الم           |
| 1 1 1            | I E                                         | 1                | Years<br>Cali   | 5 4                                            | Years of<br>the Cycle.<br>Initial date | 50               | Correct wases             | Numerals     | Current years.                      | ā        | 13 6            | Date  | Initial                        |         |         |            |               |            | Brngalre<br>Sen. |
| <u> </u>         | <u> </u>                                    | -                |                 | <u>x</u>                                       | Sep                                    | <u> </u>         | Current years             |              | Current years.                      | =        | -               | =     | 1                              | =       |         |            |               | !;         | <u> </u>         |
| 1751             | F                                           | c                | 1852            | 1673                                           |                                        | 65               | Brisya                    | 15           | Prajípati                           | 5        | Sat             | 10    | Fri                            | 9       | B 5)    |            |               | P.<br>15   | 1157             |
| B 2              | 1                                           | BA               | 3               |                                                | 8 13                                   | 66               | Chitrab'hanu              | 15           | Angira -                            | 6        |                 |       | San                            | 9       | (0)     |            |               | o          | 8                |
| 3                | , - ,                                       | G                | 4               |                                                | 9 13                                   | 67               | dúbhána                   | 17           | Srimuc'ha.                          | 7        |                 |       | Mo                             | 9,      | (1)     | 29         |               | 15         | 9                |
| 4 5              | ł I                                         | F                | 5               | . :                                            | 930 13                                 | 68               | l'árana                   | 18           | Bhává                               |          | We              | 10    |                                |         | B (2)   |            |               | . 11       | 1160             |
| B 6              | GF                                          | DC               | 6               |                                                | 1 13<br>2 13                           |                  | Párthiva<br>Vyaya         | 19<br>20     | Yovà<br>Dhát <b>á</b>               | \$<br>10 |                 |       | Th<br>Fri                      | 10<br>9 | (4)     |            |               | 45<br>0    | l                |
| 1 -              | 1 - 1                                       |                  | l '             |                                                | 1 1 1                                  | 1                | (*)                       | 21 >         | 1                                   |          |                 |       |                                | -       | (5)     | 15         | 30            |            | . 2              |
| 7                | E                                           | В                | 8               | 9                                              | 3 13                                   | 71               | Sarva Sarvad              | 21.32 \$     | Iswara                              | 11       | Sun             | 10    | sat                            | 9       | (6)     | 31         | 21            | 15         | 3                |
| 8                | D                                           | A                | 9               | 1€80                                           | 4 13                                   | 72               | Virodhi                   | 23 }         | Bahudanya                           | 12       | Mo              | 10    | Sun                            | 9       | B (0)   | 46         | 52            | 30         | 4                |
| 2                | ci                                          | G                | 4860            | 1                                              | 5 13                                   | 73               | Vicodki<br>Vicrita        | ₹3<br>24 {   | Pramát'hi                           | 13       | 1               |       | Tu                             | 1       | (2)     |            |               | 4.5        |                  |
| 1750             | 1                                           | FE               |                 | ام ا                                           |                                        |                  | \ Vicita                  | 24 5         | }                                   |          |                 |       | i                              | 1 1     | , , ,   |            |               | 45         |                  |
| 11/20            | 0.1                                         | r r              | 1               | 1                                              |                                        | 71               | C'hara<br>C'hara          | 5 }<br>25 }  | 1                                   | 14       | }               |       | We                             | 9       | (3)     | 17         | 5 <b>5</b>    | C          | 6                |
| 1                | G                                           | D                | 2               | 3                                              | 7 13                                   | 75               | Nandana                   | રહ 🕻         | Brisya                              | 15       | Fri             | 10    | Th                             | 9       | (1)     | <b>3</b> 3 | 26            | 15         | 7                |
| 2                | $ \mathbf{F} $                              | С                | 3               | 4                                              | 8 13                                   | 76               |                           | 26 {<br>27 { | Chitrab'hanu                        | 16       | Sit             | 10    | Fri                            |         | B (5)   | 48         | 57            | <b>3</b> 0 | 8                |
| -                | _                                           | . !              | l               | 1                                              | H ! '                                  |                  | \ Vijya                   | 27 }         | <br>  Súbhánu                       | 17       |                 |       | Sun                            | 10      | (0)     | 4          | 28            | 45         | o                |
| 3                | 1                                           | В                | 4               | 5                                              |                                        | 77               |                           | 28 }<br>28 } | 1                                   |          | ił              |       | ! !                            | li      | 1 ' '   | -          | •             | - "1       |                  |
| B 4              | DC                                          | AG               | 5               | 6                                              | 9 10 13                                | 73               | Munmatha                  | 29 }         | Tárana                              | 18       | : !             | 1     | Mo                             | 9       | (1)     | 20         | 0             | 0          | 1170             |
| 5                | В                                           | F                | 6               | 7                                              | 1 13                                   | 79               |                           | 29 {         | Párthiva                            | 19       | We              | 10    | Tu                             | 9       | (2)     | 35         | 31            | 15         | 1                |
| 6                | A                                           | Е                | 7               | 8                                              | 2 13                                   | 80               | S Durmuc'ha               | 30 3         | Vyaya                               | 20       | Th              | 10    | We                             | δ       | B (3)   | 51         | 2             | 30         | 2                |
|                  | 1 1                                         | ١ ١              | i '             | ļ                                              |                                        |                  | Hemalamva                 | 31 3         | Sarvajit                            | 21       |                 |       | Fri                            | 10      | 1       |            | 33            | 45         | 3                |
| 7                |                                             | D                | 8               | 1                                              | A 1                                    | 1                | Vilamva                   | 32<br>32     | 11                                  |          | H               | 1     | 11                             | 1 1     | 1       | _          |               | - : 1      |                  |
| B 8              | FE                                          | CB               | 9               | 1690                                           | 4 13                                   | 82               | { Vilaniva<br>   } Vicari | 33 {         | Sarvadhári                          | 32       |                 |       | Sut                            | 1 2     | (6)     | 2 <b>2</b> | 5             | 0          | 1 4              |
| 1 9              | D                                           | A                | 4870            | 1                                              | 5 13                                   | 83               | Vicari<br>Sarvari         | 31 {         | Viródhi                             | 123      | Mo              | 110   | Sun                            | 0       | (0)     | 37         | 36            | 15         | 5                |
| 1770             | c                                           | G                | 1               | 2                                              | 6 13                                   | 84               | Sarv. Plava               | 34.35        | Vicrita                             | 2.4      | 11              | 1     | $\mathbf{M}_{0}$               | 4       | B (1)   | 53         | 7             | 30         | 6                |
|                  | В                                           | F                |                 | ;                                              | 4 1                                    |                  | { i'lava                  | 35           | • • • • • • • • • • • • • • • • • • | 1        | 11              | 1     | !!                             | 1 1     |         |            | •             |            |                  |
| B 2              | 1 -                                         | ED               | 9               | 1                                              | 1 1 -                                  | 85<br>86         | Subhacrit<br>Sobhana      | 36<br>37     | Chara<br>   Naudana                 | 25       |                 | !     | We<br>Th                       | 10      | (3)     |            |               | 45         | 8                |
| 3                | 1                                           | C                | 4               |                                                |                                        | 87               | Crádhi                    | 33           | Vijya                               | 127      |                 | 10    |                                | 9       | (5)     |            |               | 15         | y                |
| 4                |                                             | B                | <u> </u>        |                                                | 1950 13                                |                  | Viswávasů                 | 39           | Jya                                 |          |                 |       | Sat                            |         | B (6)   |            |               | 30         | 1180             |
| 5                |                                             | A                | 6               |                                                |                                        | 89               | Parábhava                 | 40           | Manmat'ha                           | 29       |                 | !     |                                | 10      |         |            |               | 45         | 1                |
| В б              | CB                                          | GF               | 7               | 7 8                                            | 2 2 13                                 |                  | Plavanga                  | 41           | Durmuc'ha                           | 30       | 1]              | -     | Tu                             | 9       | (2)     | 26         | 15            | 0          | 2                |
| 7                |                                             | E                | 8               |                                                | 3 13                                   | 1                | Cílaca                    | 42           | Hemalamya                           | 31       | Th              | 10    | $\ _{\mathbf{W}_{\mathbf{c}}}$ | 9       | (3)     | 41         | 46            | 15         | 3                |
| 8                |                                             | D                | 13              | 9 1700                                         | 4 13                                   |                  | Saumya                    | 43           | Vilam va                            | 3%       | Fri             |       | Th                             | 9       | B (4)   | 57         | 17            | 30         | 4                |
|                  | F<br>DED                                    | C<br>BA          | 4880            |                                                |                                        |                  | Sádhárana                 | 44           | Vicári                              | 33       |                 |       | Sat                            |         | (6)     | 12         | 48            | 45         | 5                |
| 1 -              | i C                                         | G                |                 | 1 2<br>2 3                                     |                                        |                  | Viródhacrit<br>Paridhávi  | 45<br>46     | Sarvari<br> Playa                   | 35       |                 | 1,0   | Sur                            | 9       | (0)     | 28         | 20<br>51      | 15         |                  |
| 4                | 2 B                                         | F                |                 |                                                | 8 13                                   | 6                | Pramádi                   | 47           | Subhacrit                           | 36       |                 |       | Tu                             | 9       |         | 59         | 22            | 30         | 11 -1            |
|                  | 3 A                                         |                  | 11              |                                                | 9 14                                   | 7                | A'nanda                   | 48           | Sóbhana                             | 37       |                 | 1     | Th                             | 10      | (4)     | 14         | 53            | 45         | 9                |
| 1                | 4 G F<br>5 E                                |                  |                 |                                                | 960 13                                 |                  | Rac'shasa                 | 49           | Crádhi                              | 38       | Sat             |       | Fri                            | 9       | (5)     | 30         | 25            | 0          | [1190]           |
|                  | $\mathbf{\epsilon}_{\mathbf{i}} \mathbf{D}$ |                  |                 |                                                | 7 1 13<br>3 2 13                       | 10               | Anala                     | 50           | Viswá vasů                          |          |                 | 10    | Sat                            |         |         |            | 56<br>27      | 30<br>72   | 2                |
|                  | 7 C                                         | G                | 1               | 8                                              | 9 3 14                                 | 11               | Pingala<br>[Cálayucta     | 51<br>52     | Parábhava<br>Plavanga               | 110      |                 | 1     | Mo<br>Tu                       | 10      | (1)     | 16         |               | 45         |                  |
|                  | 8 BA                                        |                  |                 | 9 171                                          | 0 4 13                                 | 12               | Sidh'arti                 | 53           | Cilaca                              |          |                 | 10    | We                             |         |         | 32         | 30            | 0          | 4                |
| - 1              | 9 G                                         |                  |                 |                                                | 1 5 13<br>2 6 14                       | _ 18             | Randra                    | 54           | Saumya                              | 43       | Fri             |       | Th                             |         | B (4)   | 43         | 1             | 15         |                  |
| 179              | 0 F<br>1 E                                  |                  |                 |                                                | 2 6 14<br>3 7 14                       | 14<br>1 15       |                           | 55           | Sádhárana                           | 11       |                 | 1     |                                | 10      | (6)     | 3          | 32            |            |                  |
| В                | 2 DC                                        |                  | 11              |                                                | 4 8 1                                  | 3 16             |                           | 56           | Viródhacrit<br>Paridhávi            |          |                 | 1,0   |                                | 10      |         | 9.1<br>9.1 | 3<br>35       |            | 14 -             |
| 1                | ۶ B                                         | F                | V               | 4                                              | 5 9 1                                  | 3 17             | Ractacska                 | 58           | Pramádi                             | 17       | W               | 9/10  | Mo<br>  Tu                     | 9       | B (2)   | 50         | 6             | 15         | 9                |
| 1                | 4 A                                         |                  |                 | 5                                              | 6 970 1                                |                  | Crodhana                  | 59           | A'nanda                             | 18       |                 | 1,,   | Th                             | 10      | (4)     | ) 5        | 37            | 30         | 1200             |
|                  | 5 G<br>6 F                                  |                  |                 | 6 7                                            | 7 1 1<br>8 2 1                         | 4 19<br>3 20     | 11                        | 60           | Rac'shasa                           | 49       |                 | Į     | Fri                            |         | (5)     | 21         | 8             | 45         | 1                |
| 10               | 7 1                                         |                  | 11              | 8                                              | 9 3 1                                  | 3 21             | 11                        | 1 2          | Anala                               |          |                 |       | Sat                            |         | (6)     | 36         | 40            | 15         |                  |
|                  | 8 C                                         | ) (              | <del>:</del>    | 9 179                                          | 20 4 1                                 | 4 22             | !   Sucla                 | 3            | Pingala<br>Cálayucta                | 5:       |                 | 110   | Sur<br>Tu                      |         | B (0)   |            | 42            | 30         |                  |
| 1                | 9 I                                         |                  | 11              | 00                                             | 1 5 1<br>2 6 1                         | 12               |                           | 4            | Sid'harti                           | 5        | 3               |       | We                             | 10      | (3)     | 23         | 13            | 45         | 5                |
| <del></del>      | 00 A                                        | G! E             |                 |                                                | 2   6 1                                |                  | 11 3-1-1-1                | 5            | Raudra                              | 54       | t∥Fr            | 11    | Th                             | 10      | (4)     | 38         | 45            | 0          | 6                |

<sup>(\*)</sup> The upper names, printed in italies, are those by the Surrish Siddhanta; the lower ones, printed in roman, are those by the Jyautistava.
(+) Beginning of the Sith Cycle of Jupiter, Surrish Sidd .....

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | , T                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 17                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 11 YFT                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | , 177                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |                                          | First Chrono                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | logical                                                                                                                                                                                   | Table, continue                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | di                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |               |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ,                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | **                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Section   Column      | 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | <del>  II.</del>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | _  <u>  III.</u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | IV.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | V.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | VI.                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | Χ. Ι          | J X.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | II Vr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | X-X                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| September   Sept   | Aristian ye <b>ars.</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | expired of yug.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | xpired from<br>of Salivabana                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | years of the Erasurana.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ears of the Cycle of g                   | the Cycle o 69 years or Vrihaspatt Bengal reckoning.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | merals.                                                                                                                                                                                   | Years of<br>the Cycle of<br>60 years as<br>reckoned<br>South of the                                                                                                                                                                                                                                                                                                                                                                                                                                                          | ; Famuleivil                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | in April N. S | ereal years N S.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | Roots of beginnings<br>of Tamul years<br>consted from                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | years called                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| 6 F D 7 8 22 15 70   Pingalo 51 52                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1801<br>2<br>3<br>B 4<br>5<br>6<br>7<br>B 8<br>9<br>1810<br>B 2<br>3<br>B 4<br>5<br>6<br>7<br>8<br>9<br>1820<br>1820<br>1830<br>1830<br>1830<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840<br>1840 | F D C B A G E D C B A G E D C B A G F E D C | ## 190 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 2 3 4 5 6 7 8 9 10 1 | Je Hing X 1723 4 5 6 7 8 9 1730 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1750 1 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 3 4 5 6 7 8 9 1 2 2 2 3 4 5 6 7 8 9 1 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 2 | Parasurama.    Separate   Parasurama.   Para | 10 O O O O O O O O O O O O O O O O O O O | the Cycle of 69 years on Vrihaspatt, Bengal reckoning.  Current year Angira Srimuc'ha Bháva Yuvá Dhátá Iswara Bahudanya Pramát'hi Vicrama Brisya Chitrab'han Súbhánu l'árana Parthiva Vyaya Sarvajit Sarvadhári Viródhi Vicrita C'hara Nandana Vijya Jya Manmat'ha Durmuch'ha Hemalamva Vilamva Vicari Sarvari Plava Subhacrit Sóbhana Crádhi Viswávasù Parábhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parábhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parábhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parábhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parábhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parabhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi Parabhava Plavanga Cílaca Saumya Sádhárana Viródhacrit Paridhávi | ** 10 11 12 13 14 15 16 17 18 19 20 1 22 23 12 56 27 23 29 30 31 2 25 26 27 23 29 30 31 2 33 34 35 36 37 33 39 40 41 42 43 44 45 46 47 48 49 49 50 60 60 60 60 60 60 60 60 60 60 60 60 60 | the Cycle of 60 years as reckoned South of the River Mermada.  Current years  Durmati Dundubhi Rudiródgari Ractácsha Cródhana Cshya Prabhava(†) Vibhava Sucla Pramoda Prajápati Angira Srimucha Bhává Yuvà Dhátá Iswara Bahudanya Pramát'hi Vicrama Brisya Chuabhanu Tárana Párthiva Vyaya Sarvajit Sarvadhári Viródhi 23 Viródhi 24 Chara Nandana 25 Sarvajit Sarvadhári Virama Brisya Chuabhanu Súbhánu Tárana Párthiva Vyaya Sarvajit Sarvadhári Viródhi 25 Viródhi 26 Viródhi 27 Jya Jya Jya Jya Jya Jya Jya Jya Jya Jya | Sat   Sat | N             | No.   No. | b. 6. 7 P B (5) 54 16 15 (0) 9 47 30 (1) 25 18 45 (2) 40 50 0 B (3) 56 21 15 (5) 11 52 30 (6) 27 23 45 (0) 42 55 0 B (1) 58 26 15 (3) 13 57 30! (4) 29 28 45 B (5) 45 0 0 (0) 0 31 15 (1) 16 2 30 (2) 31 33 45 B (3) 47 5 0 (3) 33 38 45 B (3) 47 5 0 (5) 2 36 15 (6) 18 7 30 (1) 33 38 45 B (1) 49 10 0 (2) 31 33 45 B (3) 47 5 0 (5) 2 36 15 (6) 18 7 30 (1) 33 38 45 B (1) 49 10 0 (2) 31 33 45 B (3) 47 5 0 (3) 37 48 45 B (4) 10 6 15 (2) 22 17 30 (3) 37 48 45 B (6) 51 15 0 (1) 6 46 15 (2) 22 17 30 (3) 37 48 45 B (4) 53 20 0 (6) 8 51 15 (7) 24 22 30 (8) 37 38 45 B (9) 57 30 6 (9) 13 1 15 (1) 30 37 30 (1) 44 3 45 B (0) 57 30 6 (2) 13 1 15 (3) 23 32 30 (4) 44 3 45 B (5) 59 35 0 (9) 15 6 15 (1) 30 37 30 (1) 30 37 30 (1) 30 37 30 (2) 46 8 45 (4) 1 40 0 15 | 12 23 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 4 5 6 7 8 9 0 1 2 3 |
| 7 E C   8 9 23 15 71                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | _   "                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | - 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          | Pingala                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 51 }                                                                                                                                                                                      |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | Н             | 1 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | - 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| B 8 DC BA 9 1770 24 15 72 Sidharti 53 { Cilaca 42   Tu 11 (2) 3 45 0 4                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | _   "                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | - 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 11.5                                     | Calayueta<br>Culayueta                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 52 }                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | li i                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11            | 1 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 9 B G 4950 1 25 15 73 Sauraya 54 Sauraya 43 We 11 (3) 19 15 15 5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | : !                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 1 7 !!                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | (                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | ii                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11 5                                     | Sidharti<br>Sidharti                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 53 2                                                                                                                                                                                      | - ;                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 11            | [ ']                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | !                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| 1710 half of the first to the f | 9                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | BG                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | - 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 1 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |                                          | Raudra :                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 54 2                                                                                                                                                                                      | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 31            | 1 :1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | - 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| 1   2   26   15   74                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1850                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | A F                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 2                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 26 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 74                                       | Durmati                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 5 }                                                                                                                                                                                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | Fri 12                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | Th            | 11                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | (4) 34 47 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 3 .                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |

<sup>(\*)</sup> The upper names, printed in italics, are these by the Surriah Siddhanta; the lower ones, printed in roman, are those by the Jyantism sa, (t) Beginning of the 83d Cycle of Jupiter, Tellinga account.

|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | XXVI       |                                                                | • First Chronological                                           |                                                               |                                |                                   |                                |                       |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------|----------------------------------------------------------------|-----------------------------------------------------------------|---------------------------------------------------------------|--------------------------------|-----------------------------------|--------------------------------|-----------------------|
| 1851 G E   4952   1773   27   15   75   10   15   15   15   15   15   15   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | I.   II.   | i                                                              | VIII                                                            | VIII.                                                         | IX.                            | X                                 | X1.                            | XII.                  |
| 1851   G   E   4952   1773   27   15   75   \$   \$   \$   \$   \$   \$   \$   \$   \$                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | er 0.      | irred of to horizontal formal search of the Arra parasar rama. | Years of the Cycle of 60 years or Vrikaspati, Bengal reckening. | the Cycle of 60 years as reckoned South of the River Nermada, | l ferræ;<br>ount N.<br>m April | ferine of ereal years in April N. | of Tamul years<br>counted from | Bengalce years called |
| 1851   G   E   1932   1773   27   15   75   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radiródgari   57   Radir   |            |                                                                |                                                                 |                                                               | -                              | -                                 | D. G. V. P.                    |                       |
| B   2   FE   BC   3   4   28   15   76   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   38   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   39   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractárcsha   30   Ractá   | 1851 G E   | 4952 1773 27 15 75                                             | Rudiródgari 57                                                  | Viródhacrit 45                                                | Sat 12                         | Fri 11                            | B (5) 50 18 45                 | 1257                  |
| 3   D   B   4   5   29   15   77                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | B 2 FE DC  | 3 4 28 15 76                                                   | Raciácsha 58                                                    | Paridhávi 46                                                  |                                | Sun 11                            | (0) 5 50 0                     | 8                     |
| A   C   A   S   O   So   Is   T8   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya   60   Cshya     | 3 D B      | 4 5 29 15 77                                                   | Cródhana 59                                                     | Pramádi 47                                                    |                                | Mo 11                             | (1) 21 21 15                   | 9                     |
| S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 4 C A      | 5 6 30 15 78                                                   | 11 7                                                            | A'nanda 48                                                    | We 12                          | Tu 11                             | (2) 36 52 30                   | 1250                  |
| B 6 AG FE                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 5 B G      | 6 7 31 15 79                                                   | Scshya 60                                                       | Rac'shasa 49                                                  | Th   12                        | We 11                             | B (3) 52 23 45                 | 1                     |
| The color of the   | B 6 AG FE  | 7 8 22 15 80                                                   | S Prabh. Vibh. +1.2                                             | Anala 50                                                      |                                | Fri 11                            | (5) 7 55 0                     | 2                     |
| 9 D B 4960 1 35 15 83                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1 - 1 -    |                                                                | Sucla 3                                                         |                                                               |                                | / w t                             |                                | 3                     |
| 1860   CB   AG   1   2   36   15   84   Angira   54   Durmati   55   Dundubhi   56   Sat   12   Fri   11   (4) 25   31   15   C   A   6   7   8   42   15   90   Sat   15   C   C   A   6   7   8   42   15   90   Sat   15   C   C   A   6   7   8   43   15   1   C   C   A   A   Angira   Argi   |            |                                                                |                                                                 | Sidh'arti 52                                                  |                                |                                   |                                | 5                     |
| 2 G E 3 4 38 15 86 Bhárá 9 Rudiródgari 57 San 12 Sat 11 (5) 41 2 30 Rudiródgari 57 San 12 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 1 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 5 0 Sat 12 Sat 11 (1) 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 12 Sat 13 Sat 12 Sat 13 Sat 12 Sat 13 Sat 12 Sat 13 Sat 12 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13 Sat 13  | 1860 CB AG | 1 2 36 15 84                                                   | Angira 6                                                        | Raudra 54                                                     |                                | We  11                            | (3) 10 0 0                     | σ                     |
| 3 F D 4 5 39 15 87                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |            |                                                                | Continue again                                                  |                                                               | Sat 19                         | 1 - ** 1 1                        |                                | 8                     |
| 5 C A 6 7 41 15 89 Iswara 11 Cródhana 59 Th 12 We 11 (2) 27 36 15 Cshya 60 Th 12 We 11 (3) 43 7 30 Cscle 7 A F 8 9 43 15 1 Pramát'hi 13 Prabhava(‡) 1 Fri 12 Th 11 B (4) 58 38 45 Vicrama 14 Vibhava 2 Sucla 3 Sucla 3 Sucla 3 Sucla 15 Chitrab'hanu 17 Pramóda 4 Tu 12 Mo 11 B (1) 45 12 30 1 Sucla 17 Pramóda 4 Tu 12 Mo 11 B (1) 45 12 30 1 Sucla 17 Pramóda 4 Tu 12 Mo 11 B (1) 45 12 30 1 Sucla 17 Prajápati 5 No 11 C A 2 3 47 15 5 Subhánu 17 Prajápati 5 No 11 C A 2 3 47 15 5 Subhánu 17 Prajápati 5 No 11 C A 2 3 48 15 C Sucla 17 Prajápati 5 No 11 C A 2 3 49 15 5 Subhánu 17 Prajápati 5 No 11 C A 5 Sucla 17 Prajápati 5 No 11 C A 5 Sucla 17 Prajápati 5 No 11 C A 5 Sucla 18 No 11 Simuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 10 Srimuc'ha 10 Sucla 10 Sucla 11 C Sucla 11 C Sucla 11 C Sucla 11 C Sucla 11 C Sucla 11 C Sucla 11 C Sucla 12 Fri 11 C Sucla 12 Sucla 12 Sucla 12 Sucla 12 Sucla 12 Sucla 12 Sucla 12 Sucla 13 Sucla 14 C Sucla 15 Sucla 15 Sucla 15 Sucla 15 Sucla 15 Sucla 15 Sucla 16 Sucla 17 Sucla 18 Sucla 18 Sucla 18 Sucla 18 Sucla 18 Sucla 18 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla 19 Sucla  | 3 F D      | 4 5 39 15 87                                                   | Yuvá 9                                                          | Rudiródgari 57                                                | Sun 12                         | Sat 11                            | B (6) 56 33 45                 | 9                     |
| 6 B G 7 8 42 15 90 Bahudanya 12 Cshya 60 Th 12 We 11 (3) 43 7 30 Cycle 7 A F 8 9 43 15 1 Pramát'hi 13 Prabhava(‡) Fri 12 Th 11 B (4) 58 38 45 14 Vibhava 2 15 Sat 11 (6) 14 10 0 15 Sucla 3 Sucla 3 Sucla 15 Sucla 3 Sucla 16 Pramoda 4 Tu 12 Mo 11 B (1) 45 15 3 Sucla 17 Prajápati 5 Sucla 18 Angira 6 We 12 (3) 0 43 45 Sucla 18 Angira 18 Angira 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 10 Sucla 10 Sucla 10 Sucla 11 (4) 16 15 0 Srimuc'ha 11 (5) 31 46 15 4 Sucla 15 Sucla 17 Prajápati 5 Simuc'ha 18 Angira 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 19 Srimuc'ha 10 Srimuc'ha 10 Srimuc'ha 10 Srimuc'ha 11 (4) 16 15 0 Srimuc'ha 11 (4) 16 15 0 Srimuc'ha 12 Sucla 12 Fri 11 (5) 31 46 15 Secrea 11 Secrea 12 Sucla 13 Sucla 14 Sucha 15 Sucha 15 Sucha 16 Sucha 17 Sat 12 Fri 11 (5) 31 46 15 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea 11 Secrea  |            |                                                                | 1 2                                                             | 10                                                            |                                |                                   |                                | 1270                  |
| 7 A F 8 9 43 15 1 Pramát'hi 13 Prabhava(‡) 1 Fri 12 Th 11 B (4) 58 38 45 Vicrama 14 Vibhava 2 15 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla 3 Sucla | 1 0        | 7 8 42 15 90                                                   | Bahudanya 12                                                    |                                                               | Th 12                          | 1~~1                              |                                | 2                     |
| B & GF ED   9   1790   4   15   2   Vicrama   14   Vibhava   2   3   Sat   11   (6) 14   10   0   1870   D   B   1   2   46   15   4   Chitrab/hanu   16   Pramoda   4   Tu   12   Mo   11   B.(1)   45   12   30   12   C   A   2   3   47   15   5   Súbhánu   17   Prajápati   5   We   12   (3) 0   43   45   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   0   0   15   0   15   0   15   0   15   0   15   0   15   0   0   0   15   0   0   0   15   0   0   0   0   0   0   0   0   0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | 7 A F      | 8 9 43 15 Cycle                                                |                                                                 | Prabhava(†)                                                   | Fri 12                         | Th 11                             | B (4) 58 38 45                 | 3                     |
| 1870   D   B   1   2   43   15   4   Chitrab/hanu   16   Pramoda   4   Tu   12   Mo   11   B.(1) 45   12   30   12   C   A   2   3   47   15   5   Súbhánu   17   Prajápati   5   We   12   (3) 0 43 45   44   15   0   Tárana   18   Angira   6   Th   11   (4) 16 15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0   15   0     | B SGF ED   | 9 1790 41 15 2                                                 | Vicrama 14                                                      | Vibhaya 2                                                     |                                | Sat 11                            | (6) 14 10 0                    | 4                     |
| 1 C A       2       3   47   15   5   Súbhánu       17   Prajápati       5   We   12   (3) 0 43 45           B 2 BA GF       3   4   48   15   6   Tárana       18   Angira   6   Th   11   (4) 16   15   0           3 G E   4   5   49   15   7   Parthiva   Parthiva   Parthiva   19   Srimuc'ha   Parthiva   19   Srimuc'ha   12   Fri   11   (5) 31 46   15           4 F D   5   6   50   15   8   Vyaya   20   Bhává   8   Sun   12   Sat   11   B (6) 47   17   30   1           5 E C   6   7   51   15   9   Sarvajit   21   Yuva   9   Mo   12   (1)   2   48   45           B 6 DC BA   7   8   52   15   10   Sarvadhári   22   Dhátá   10   Tu   11   (2)   13   20   0           7 B G   8   9   53   15   11   Viródhi   23   Iswara   11   Th   12   We   11   (3)   33   51   15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 1 - 1      | 1 11 11 11 11                                                  | 1,0110,0                                                        |                                                               | 11 1 1                         |                                   |                                | 5                     |
| 3 G E 4 5 49 15 7 Parthiva 4 F D 5 6 50 15 8 Vyaya 5 E C 6 7 51 15 9 Sarvajit 7 B G 8 9 53 15 11 Viródhi 20 Srimuc'ha 7 Sat 12 Fri 11 (5) 31 46 15 8 Sun 12 Sat 11 B (6) 47 17 30 1 1 Yuva 9 Mo 12 (1) 2 48 45 10                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1 C A      | 2 3 47 15 5                                                    | Súbhánu 17                                                      |                                                               |                                |                                   |                                | 7                     |
| 4 F D 5 6 50 15 8 Vyaya 20 Bhává 8 Sun 12 Sat 11 B (6) 47 17 30 1 5 E C 6 7 51 15 9 Sarvajit 21 Yuva 9 Mo 12 (1) 2 48 45 16 DC BA 7 8 52 15 10 Sarvadhári 22 Dhátá 10 Tu 11 (2) 13 20 0 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1          |                                                                |                                                                 | 1                                                             |                                | 1                                 | 1 ' '                          | 8                     |
| 5 E C 6 7 51 15 9 Sarvajit 21 Yuva 9 Mo 12 (1) 2 48 45 52 15 10 Sarvadhári 22 Dhátá 10 Tu 11 (2) 18 20 0 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | -1 -1      |                                                                |                                                                 | la                                                            |                                |                                   |                                |                       |
| 7 B G 8 9 53 15 11 Viródhi 23   Iswara 11   Th   12   We   11   (3) 33 51 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   | ~          | 1 11 1 11                                                      | Sarvajit 21                                                     | Yuva 9                                                        |                                | Mo 12                             | (1) 2 48 45                    | 1 1                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1          | 11 441.41                                                      |                                                                 |                                                               | Th 12                          | 1 - 4                             | 1 3 7                          | 2 3                   |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 8 A F      | 9 1800   54 15   12                                            | Vicrita 24                                                      | Bahudanya 12                                                  | Fri 12                         | Th 11                             | B (4) 49 22 30                 | 4                     |
| 9 G E 4980 1 55 16 13   Chara 25   Pramathi 13                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            | 1 1 00                                                         |                                                                 | Pramat'hi 13                                                  |                                |                                   | (6) 4 53 45                    |                       |
| 1 D B 2 3 57 15 15 Vijya 27 jBrisya 15 Tu 12 Mo 11 (1) 35 56 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | 1 D B      | 2 3 57 15 15                                                   | Vijya 27                                                        | Brisya 15                                                     | Tu  12                         | Mo 11                             | (1) 35 56 15                   | 7                     |
| 2 C A S 4 58 15 16 Jya 28 Chitrab'hanu 16 We 12 Tu 11 B 2 51 27 30 Súbhánu 17 Th 12 (4) 6 58 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |            | 1 11 11 11                                                     | 11 /                                                            | Chitrab'hanu 16                                               |                                | Tu 11                             | B (2) 51 27 30                 | 8 9                   |
| B 4 AG FE 5 6 60,15 18 Durmuch'ha 30 Tarana 18 Fri 11 (5) 22 30 0 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | B 4 AG FE  | 5 6 60,15 18                                                   | Durmuch'ha 30                                                   | Tárana 18                                                     |                                | Fri 11                            | (5) 22 30 0                    | 1290                  |
| 5 F D 6 7 61 15 19 Hemalamva 31 Párthiva 19 Sun 12 Sat 11 (6) 38 1 15 6 E C 7 8 62 15 20 Vilamva 32 Vyaya 20 Mo 12 Sun 11 B (0) 53 32 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 3 1 .      | 1, 91,101,10                                                   |                                                                 |                                                               | Sun 12                         | Sat 11                            | (6) 38 1 15<br>D (0) 53 92 20  | 1 2                   |
| 7 D B 8 9 63 16 21 Vicari 23 Sarvajit 21 Tu 12 (2) 9 3 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 7 D B      | 8 9 63 16 21                                                   | Vicari 23                                                       | Sarvajit 21                                                   | 310 12                         | Tu   12                           | (2) 9 3 45                     | 3                     |
| B 8 CB AG 9 1810 64 15 22 Sarvari 34 Sarvadhári 22 We 11 (3) 24 35 0 9 A F 4990 1 65 15 23 Plava 35 Viródhi 23 Fri 12 Th 11 (4) 40 6 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | -1 . 1 +-  | 1 0 1 0 1                                                      |                                                                 |                                                               |                                |                                   |                                |                       |
| 1890 G E 1 2 66 15 24 Subhacrit 36 Vicrita 24 Sat 12 Fri 11 B 5 55 37 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |            | 1 2 66 15 24                                                   | Subhacrit 36                                                    | Vicrita 24                                                    | Sat 12                         | Fri 11                            | B (5) 55 37 30                 |                       |
| 1 F D 2 3 67 16 25 Sóbhana 37    Chara 25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |            |                                                                | Sóbhana 37                                                      | Chara 25                                                      |                                | Sun 12                            | (O) 11 8 45                    | 7                     |
| 3 C A 4 5 69 15 27 Viswavasu 39 Viiva 27 We 12 Tu 11 (2) 42 11 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3 C A      | 4 5 69 15 27                                                   | Viswavasu 39                                                    | Viiva 27                                                      | We 12                          | To [11]                           | (2) 42 11 15                   | . 8                   |
| 4 B G 5 6 70 15 28 Parabhava 40 Jya 28 Th 12 We 11 B 3 57 42 30 1.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 4 B G      | 5 6 70 15 28                                                   | Parábhava 40                                                    | Jya 28                                                        | Th 12                          | We 11                             | B (3) 57 42 30                 | 1300                  |
| B 6 GF ED 7 8 72 15 30 Cilaca 42 Durmucha 30   131 (6) 28 45 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |            | 7 8 72 15 30                                                   | Cílaca 42                                                       | 1 1 1                                                         |                                |                                   |                                |                       |
| 7 E C 8 9 73 15 31 Saumya 43 Hemalamva 31 Mo 12 Sun 11 (0) 44 16 15                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 7 E C      |                                                                | Saumya   43                                                     | Hemalamva 31                                                  | Mo 12                          | Sun [11]                          | (0) 44 16 15                   | 3                     |
| 9 C A 5000 1 75 16 33 Viródhacrit 45 Vicári 33 Ve 12 (3) 15 18 45                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |            | <b>5000 1 75 16 33</b>                                         | Viródhacrit 45                                                  | Vilamva 32<br>Vicári 33                                       | Tu 12                          | Mo 11<br>W. 12                    | B (1) 59 47 30<br>(3) 15 18 45 | 4 5                   |
| 1900 BA G 1 2 76 16 34 Paridhavi 46 Sarvari 34 Fri 13 Th 12 (4) 30 50 0                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |            |                                                                | Paridhávi 46                                                    | Sarvari 34                                                    | Fri 13                         |                                   | (4) 30 50 0                    |                       |

<sup>(\*)</sup> The upper names, printed in italies, are those by the Surriah Siddhanta; the lower ones, printed in roman, are those by the Jyantistaya.

<sup>(+)</sup> Beginning of the 85th Cycle of Jupiter, Surriah Siddhanta,

<sup>(†)</sup> Beginning of the 84th Cycle, Tellinga account.

SECOND CHRONOLOGICAL TABLE shewing the principal circumstances of the common Luni.solar year vin use in the Peninsula of India, and the concurring Fuzelee or revenue years.

| B   1600   1701   A   Wednes   12 Mar   Monday   2 April   18   8   9   4    16    16    16    16    16    16    16    16    16    16    16    16    16    16    16    16    16    16    16    17    16    16    17    16    17    16    17    16    17    16    17    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    18    |              | XII.       | 4          | , XI.   | , X.      | IX.              | VIII  | VII.  | VI.      | į v.        | IV.        | · III.         |           | I.            | -             |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------|------------|------------|---------|-----------|------------------|-------|-------|----------|-------------|------------|----------------|-----------|---------------|---------------|
| B   1600   1701   A   Wednes   15 Mar   -97   -31   30   1717078   54   35   0   1717075   637   1009   30   30   34   4   5   5   6   A   Saturday   23 Mar   16   30   30   1717809   25   37   30   1717705   9   1   30   30   31   17181539   56   40   0   1718533   1   3   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |              |            | 2          | 1       | -         |                  | g .   | . i   | E F      | Data Cir    |            | j <sub>0</sub> | Sn.       |               |               |
| B   1600   1701   A   Wednes   15 Mar   9   30   30   1717078   54   35   0   1717070   637   1000   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | futial date, | date       | rean<br>d. | it &    | Ahargana  |                  | rati, | 神     |          |             |            | ar.            | in y      |               |               |
| B   1600   1701   A   Wednes   15 Mar   9   30   30   1717078   54   35   0   1717070   637   1000   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | da %         | ial<br>S.  | يَّ وَ ا   | Page D  |           |                  | E를    | f C   | i i i    | conjunction | Luni-solar | ye             | j ĝ ĝ     | tiat<br>a rs. |               |
| B   1600   1701   A   Wednes   15 Mar   (**)   So   1717078 54 35 0   DAYA   1657   1009   30   30   1717744   10   6   15   1717078   1657   1009   30   30   30   1717744   10   6   15   171740   8   1010   30   30   30   30   1717744   10   6   15   171740   8   1010   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | EZ           | ( i i      | exp        | ž Ę     |           |                  | i y   | de de | S it     | in do.      | year.      | the the        | E E       | risi<br>Xe    |               |
| B   1600   1701   A   Wednes   15 Mar   Monday   2 April   27   \$31   \$30   1717078   54   \$50   1717075   657   1009   30   30   30   30   1717078   54   \$50   1717075   657   1009   30   30   30   30   30   1717078   54   \$50   1717075   657   1009   30   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | Int          |            | Fu         | Yea     | Thursday. |                  | Ö     | Sy    | <u> </u> |             |            | <u>  5</u> _   | 2 2       | <u> </u>      | _             |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | July         |            | i          |         |           |                  | , n   |       |          | 15 M        | Wodaas     |                | 170:      | 1600          | _             |
| Saturday  | 10           | 30         | :          |         |           |                  |       |       | 1 -      | i e         | 1          | _              |           | 1000          | 15            |
| S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           |            | 1          |         | 1         |                  |       | 11    | 1 .      |             |            |                |           | o.            |               |
| B   4   5   Tuesday   30   Mar   -24   30   30   1718539   56   40   0   1718538   1   3   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10           | 1 -        |            |         |           |                  |       | 11 1  |          |             |            |                |           |               |               |
| Sample                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 11           | 1          |            | •       |           |                  |       | 12    |          |             | 1          |                |           |               | 13            |
| Thursday   Samar   S | 10           | ı          | _          |         | 1         |                  |       | 11    |          |             |            |                | _         |               | 1             |
| R                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           |            | 1          |         |           |                  | l .   |       | 1        |             | Thursday   | ı              | 7         |               |               |
| B   S   9   A   Sunday   16 Mar   -10   30   30   1720000 58 45 0   1719980   5   7   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 11           |            |            |         |           |                  |       | 11    | 21       |             | Wednes     |                |           | 7             |               |
| 9   4710                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10           | -          |            | _       |           |                  | 1     | 11    | _10      | 16 Mar      |            | A              | 9         | 8             | B             |
| 1610                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10           |            | -          |         |           |                  | 30    | 31    | 29       | 4 April     | Saturday   |                | 4710      | 9             |               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           |            | i i        |         | 1720718   | 1720731 29 47 30 |       | 16    | 1        |             |            |                |           |               |               |
| B   2   3   A   Thursday   1   April   -26   31   30   1721462   0   50   0   1721457   9   1   30   30   30   30   1721827   16   21   15   1721811   1670   2   30   30   30   30   1721827   30   1722165   1   3   30   30   31   30   31   322195   31   32   30   30   30   31   32   30   30   30   31   32   30   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 11           | _          |            |         |           |                  | 1     | 11    | 1        |             |            | A              |           |               | 1             |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           |            | l i        |         | 1721457   | 1721462 0 50 0   |       | 11 -  | 26       | 1 April     | Sunday     | !              |           |               | B             |
| B   6   7   A   Friday   18   Mar   -12   31   30   1722557   47   23   45   1722549   2   4   1   1   1   1   1   1   1   1   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 10           | 30         |            |         | 1721811   | 1721827 16 21 15 |       | 11    | 1        |             |            | A              |           |               |               |
| B   6   7   A   Friday   18   Mar   -12   31   30   1722923   2   55   0   172294   3   5   30   30   30   30   30   30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 10           |            | ł          | - 1     |           |                  | 1     |       |          | _           |            |                |           | _             |               |
| Thursday  | 11           | _          | ,          |         |           | 1                |       | 11    |          | _           |            |                |           |               | 1             |
| 8 9 4720 A Friday 15 Mar 8 30 31 1723653 33 57 80 1723642 5 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           | 30         | 5          | 3       | 1722904   | 1722923 2 55 0   | 30    | 31    | 12       | 18 Mar      | triday     | A              | 7         |               | Ľ             |
| 8   9   4720         A   Friday   15 Mar   8   30   31   1723653   33   57   30   1723642   5   7   1   1   1723996   6   8   1   1   1   1   1   1   1   1   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10           | <b>3</b> 0 | 6          | 4       | 1723287   | 1723288 18 26 15 | 30    | 31    | 30       | 5 April     | Wednes     |                | 8         |               |               |
| B   1620   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 | 11           |            |            | 5       |           | 1                | 1 1   | 11 -  |          | 26 Mar      |            |                |           |               |               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11           |            | _          |         |           |                  |       | F1 -  |          |             |            | . А            | 1         |               |               |
| 2   3   A   Saturday   12 Mar   5   30   31   1725114   36   2   30   1725089   9   1   1   1   3   4   5   A   Tuesday   19 Mar   -13   31   30   1725479   51   33   45   1725473   1680   2   1   3   3   3   3   3   3   3   3   3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 10           |            | 1          |         | i         |                  |       | 11    |          |             |            |                |           | 1620          | Ľ             |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 10           |            | 1          | 1       | 1         |                  |       | 11 -  | 1        |             |            |                | 2         | ]             |               |
| 3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11           | _          |            | :       |           |                  |       | 11    |          | -           |            | A              |           |               |               |
| Saturday  | 11<br>10     | - :        |            | l 1     |           |                  |       |       |          |             |            |                | <b>\$</b> |               | 3             |
| 6         7         Friday         27 Mar         20         30         31         1726575         38         7         30         1726565         3         5         1           B         8         9         Tuesday         4 April         -29         31         30         1727306         9         10         0         1727304         5         7         30           9         1730         Saturday         24 Mar         17         30         30         1727671         24         41         15         1727658         6         8         30           1         2         Tuesday         1 April         -25         30         30         1728401         55         43         45         1728396         8         1040         1           8         2         3         A         Sunday         1 Mar         -15         31         30         1729132         26         46         15         1729105         1690         2         30           1         4         5         Wednes         29 Mar         22         30         31         1729132         26         46         15         1729105         1690                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |              |            |            |         |           |                  |       | II    | ·        |             |            |                |           |               | -             |
| B   8   9   Tuesday   4 April   -29   31   30   1726940   53   38   45   1726920   4   6   1   1730   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     5   1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730     1730  | 10           |            | 1          |         |           |                  |       |       |          | -           | Saturday   |                | 6         |               |               |
| S   9   Tuesday   4 April   -29   31   30   1727306   9   10   0   1727304   5   7   30   30   1727306   9   10   0   1727304   5   7   30   30   1727671   24   41   15   1727658   6   8   30   30   1727671   24   41   15   1727658   6   8   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   7   9   1   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1728012   30   30   1738012   30   30   1738012   30   30   30   30   30   30   30   3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | 11<br>11     |            |            |         |           |                  | ì     |       | 1        |             |            |                |           | -             |               |
| 1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730   1730    | 10           | -          |            |         |           |                  |       |       |          |             |            | Δ.             |           |               | В             |
| 1630                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         | 10           |            |            | į į     |           |                  |       | 3 "   |          |             |            |                |           | -             | -             |
| B         1         2         A         Tuesday Sunday         1 April 21 Mar         -25         30         30         1728401         55         43         45         1728396         8         1040         1         30         1728767         11         15         0         1728767         11         15         0         1728751         9         1         30         30         1728767         11         15         0         1728751         9         1         30         30         1729132         26         46         15         1729105         1690         2         30         31         1729132         26         46         15         1729105         1690         2         30         31         1729132         26         46         15         17291489         1         3         1         31         17291497         42         17         30         17291489         1         31         1         31         31         31         31         31         31         32         32         32         32         32         32         32         32         32         32         32         32         32         32         32         32                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 11           |            |            | - 71    |           |                  |       |       |          | _           | Wednes     | A              |           | •             |               |
| S                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11           |            | 1040       |         |           | 1728401 55 43 45 | 30    | 1 1   |          |             |            |                |           | 1             | _             |
| 4   5   Wednes   29 Mar   22   30   31   1729497 42 17 30   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   1   1729489   1   3   3   1   1729489   1   3   3   3   1730223   1   3   3   3   3   1730223   1   3   3   3   3   3   3   3   3                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10           | <b>3</b> 0 | 1          | 9       | 1728751   |                  |       | 31    |          |             |            | A              | 3         | 2             | 8             |
| 4   5   6   A   Wednes   29   Mar   22   30   31   1729497   42   17   30   1729489   1   3   1   1   1   1   1   1   1   1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  | 10           | <b>3</b> 0 | 2          | 1690 II | 1729105   | 1729132 26 46 15 | 30    | 30    | 3        | 10 Mar      |            |                |           | 3             | _             |
| B 5 6 A Sunday Saturday 5 April 30 30 1729862 57 48 45 1729843 2 4 1 30 30 1730223 13 20 0 1730227 3 5 30 30 1730223 13 20 0 1730227 3 5 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | 11           | 1          |            |         | 1729489   | 1729497 42 17 30 | 31    |       |          |             | Wednes     | ļ              |           |               | İ             |
| B 6 7 8 7 8 8 9 A Monday 15 Mar 8 30 31 1730223 13 20 0 1730227 3 5 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 6 30 30 1730582 4 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11           |            | 4          |         | 1729843   | 1729862 57 48 45 | 30    |       |          |             |            | A              |           | 5             | _             |
| 7 8 8 9 A Monday 15 Mar 8 30 31 1730593 28 51 15 1730582 4 6 30 1730582 4 6 30 1730582 4 22 30 1730936 5 7 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 10           |            | 5          |         | 1730227   | 1730223 13 20 0  | 30    |       |          |             |            |                | 7         |               | B             |
| 8 9 A Monday 15 Mar 8 30 31 1730958 44 22 30 1730936 5 7 1 9 1740 Sunday 3 April 27 30 30 30 1731323 59 53 45 1731320 6 8 1 Thursday 22 Mar 16 31 30 1731689 15 25 0 1731674 7 9 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10           |            |            | !1      | 1730582   | 1730593 28 51 15 | 30    |       |          |             | Thursday   | 1              | 8         |               |               |
| R 1640 1 Thursday 22 Mar16 31 30 1731689 15 25 0 1731674 7 9 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11           |            |            | . 11    | 1730936   | 1730958 44 22 30 | 31    |       |          | 15 Mar      | Monday     | A              | 9¦        |               |               |
| 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            | 11           |            | l i        |         | 1731320   | 1731323 59 53 45 | 30    |       |          |             |            | Ì              |           | 1640          | b             |
| , <u>, , , , , , , , , , , , , , , , , , </u>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <u> </u>     |            |            |         |           |                  | 1     | 31    | -16      | 22 Mar      | Thursday   |                | _1        | 1040          | ļ' <u>'</u> - |
| 1 2 A Tuesday 12 Mar 5 30 31 1732054 30 56 15 1732029 8 1050 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 10           | 30         | 1050       | 8       |           |                  |       |       |          | 12 Mar      | Tuesday    | A              | 3         | 1             | 1             |
| 2 3 Sunday 30 Mar 23 30 31 1732419 46 27 30 1732412 9 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 11           | ,          |            | 1       |           |                  |       |       |          | 30 Mar      | Sunday     | - 1            |           | 2             |               |
| 3 4 A Friday 20 Mar 13 31 30 1732765 1 58 45 1732767 1700 2 1 1 3 30 1733150 17 30 0 1733121 1 3 30                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 11<br>10     |            |            |         | i i       | <del>-</del> -   |       |       | - 4      |             |            | A              | 4         | 3             | В             |
| 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | 10           |            | 1 7        |         |           |                  |       |       |          |             |            |                | 5         | 4             | السديا        |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11           | - 1        |            |         |           |                  |       |       | '1       |             |            | _              | oj.       | s<br>Al       |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 11           | l l        |            |         |           |                  |       |       |          |             |            |                | 4         | 7             |               |
| B 6 1 1 20 1 20 1 20 1 20 1 20 1 20 1 20                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | 10           | - 1        |            |         |           |                  |       |       |          |             |            |                |           | 8             | В             |
| 9 1750 A Saturday 13 Mar 6 30 31 1734976 35 6 15 1734952 6 8 1                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | 11           | 1          |            |         |           |                  |       |       | ***      |             | 1          |                |           |               |               |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 3.1          | 1          |            |         |           |                  |       |       | 12       |             |            |                |           |               |               |

<sup>(\*)</sup> The stroke - before the figure, indicates that the Civil Solar date is one less.

|           | Ī.             | II.                           | III.                      | IV.                                         | V.                                       | VI. p                            |                                   | VIII,                        | IX.                                                                 | X.                                                              | XI.                                                                           |                           | KII.                     |                |
|-----------|----------------|-------------------------------|---------------------------|---------------------------------------------|------------------------------------------|----------------------------------|-----------------------------------|------------------------------|---------------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------------------------------------------------------|---------------------------|--------------------------|----------------|
| Christian |                | Years expired of the Cali yug | Character of<br>the year. | Last feria<br>in the<br>Luni solar<br>year. | Date of the last mean conjunction in do, | Date in Chitta<br>of Solar year. | Sydereal dura-<br>tion of Chitra. | Civil duration<br>of Chitra. | Solar Abargana,<br>or Yugadia,<br>to be counted from<br>Friday.     | Luni-solar<br>Ahargana<br>to be<br>counted<br>from<br>Thursday. | Years of Era                                                                  | Fuzelce years<br>expired. | June                     | July Vale,     |
| 1<br>B    | 651<br>2       | 4752                          | A                         | Tuesday<br>Sunday                           | 21 Mar<br>10 Mar                         | Syd<br>14<br>3                   | 31  <br>30                        | <b>30</b><br>30              | 1736072 21 40 0                                                     | 1735690<br>1736045                                              | 9                                                                             | 1060                      | July<br>1.<br>30         | 11             |
|           | 3<br>4<br>5    | 4<br>5<br>6                   | A                         | Saturday<br>Wednes<br>Tuesday               | 29 Mar<br>18 Mar<br>6 April              | 29<br>—11<br>—30                 | 30<br>30<br>31                    | 31<br>30<br>30               | 1775802 52 42 30                                                    | ,17.36429<br>),1736783<br>5 1737167                             | 1710<br>1<br>2                                                                | 2<br>3<br>4               | 1<br>1<br>1              | 11<br>11<br>11 |
| В         | 6<br>7<br>8    | 7<br>8<br>9                   | A                         | Saturday<br>Thursday<br>Tuesday             | 25 Mar<br>15 Mar<br>2 April              | 18<br>8<br>—26                   | 30<br>30<br>30                    | •30<br>31<br>30              | 1737533 23 45 0<br>1737898 39 16 15<br>1738263 54 47 30             |                                                                 | 3<br>4<br>5                                                                   | 5<br>6<br>7               | 30<br>1<br>1             | 10<br>11<br>11 |
| В 1       |                | 4760<br>1                     | A                         | Sunday<br>Thursday                          | 23 Mar<br>11 Mar                         | 16<br>4                          | 31<br>30                          | 30<br>30                     |                                                                     | 1738968                                                         | 1 . '                                                                         | 8<br>9<br>1070            | 30<br>1                  | 11<br>10<br>11 |
|           | 1<br>2<br>3    | 2<br>3<br>4                   | A                         | Wednes<br>Sanday<br>Saturday                | 30 Mar<br>19 Mar<br>7 April              | 23<br>12<br>31                   | 31                                | 31<br>30<br>30               | 1739724 56 52 30<br>1740090 12 23 45                                | 5 1739 <b>352</b><br>0 17 <b>3</b> 9706<br>5 1740090            | 9<br>1720                                                                     | 1070                      | 1                        | 11<br>11<br>10 |
| В         | 4<br>5<br>6    | 5<br>6<br>7                   | A                         | Thursday<br>Monday<br>Sunday                | 27 Mar<br>16 Mar<br>4 April              | 20<br>9<br>—28                   | 30<br>30<br>30                    | 30<br>31<br>30               | 1740455 27 55 0<br>1740820 43 26 15<br>1741185 58 57 30             |                                                                 | 2                                                                             | 4                         | 30<br>1<br>1             | 11 11          |
| В         |                | 9                             | A                         | Thursday<br>Tuesday                         | 24 Mar<br>13 Mar                         | 17<br>6                          | 30                                | 30<br>31                     | 1741916 30 0                                                        | 5 1741537<br>0 1741892<br>5 1742276                             | 5                                                                             |                           | 1<br>30<br>1             | 11<br>10<br>11 |
| Ì         | 9<br>1670<br>1 | 1<br>2                        | A                         | Monday<br>Friday<br>Tuesday                 | 1 April<br>21 Mar<br>10 Mar              | 25<br>—14<br>— 3                 | 30<br>31<br>31                    | 30 30                        | 1742647 1 2 30<br>1743012 16 33 4                                   | 0 1742630<br>5 1742984<br>0 1743368                             | 8                                                                             | 9                         | 1<br>1<br>30             | 11<br>11<br>10 |
| В         | 2<br>3<br>4    | 4                             | A                         | Monday<br>Saturday<br>Friday                | 28 Mar<br>  18 Mar<br>  6 April          | 2!.<br>11<br>30                  | 30<br>30<br>31                    | 31<br>31<br>30               | 1743742 47 36 1                                                     | 5 1743723<br>0 1744107                                          | 1730                                                                          | 2                         | 1                        | 11             |
| В         | 5              | 7                             | A                         | Tuesday<br>Saturday                         | 26 Mar<br>14 Mur<br>2 April              | 19<br>7<br>26                    | 31<br>30<br>30                    | 30<br>31<br>31               | 1744838 34 10                                                       | 5 1744461<br>0-1744813<br>5 174519                              | 5 3                                                                           | 4<br>5<br>6               | • 1<br>1<br>1            | 11<br>11<br>11 |
|           | 7<br>8<br>9    | 9<br>4780                     | A                         | Friday<br>Wednes<br>Sunday                  | 23 Mar<br>12 Mar                         | -16<br>4<br>23                   | 31<br>30                          | 30<br>30<br>31               | 1745569 5 12 3<br>1745934 20 43 4                                   | 0 174555                                                        | 5<br>3 6                                                                      | 8                         | 1                        | 11<br>11<br>11 |
| B         | 1680<br>1<br>2 | . 2                           |                           | Saturday<br>Wednes<br>Tuesday               | 30 Mar<br>19 Mar<br>7 April              | —12<br>—31                       | 30                                | 30<br>30                     | 1740239 30 13<br>1746664 51 46 1<br>1747030 7 17 3                  | 5 174664<br>0 174703                                            | 6 8<br>0 9                                                                    | 1090                      | 1                        | 11 11          |
| В         | 4              | 3 4<br>4 5                    | A                         | Saturday<br>Thursday<br>Wednes              | 27 Mar<br>16 Mar<br>4 April              | 19<br>9<br>—28                   | 30                                | 30<br>31<br>30               | 1747760 38 20<br>1748125 53 51 1                                    | 5 174738<br>0 174773<br>5 174812                                | $\begin{vmatrix} 9 \\ 3 \end{vmatrix} = \begin{vmatrix} 1 \\ 2 \end{vmatrix}$ | 3                         | 1                        | 11<br>11<br>11 |
| В         |                | 6 7<br>7 8<br>8 9<br>9 4790   | A                         | Sunday<br>Thursday<br>Wednes<br>Monday      | 31 Mar<br>21 Mar                         | 24<br>14                         | 30<br>30<br>30<br>30              | 30<br>31<br>30               | 1748856 <b>2</b> 4 53 4<br>1749221 40 <b>2</b> 5<br>1749586 55 56 1 | 0 174921<br>5 174957                                            | 1 4<br>5 8<br>0 6                                                             | S 8                       | _                        | 11<br>11<br>11 |
| B         | 169            | 1,                            | 1 - A                     | Friday Thursday Monday                      |                                          | 21                               | 30                                | 30                           | 1750317 26 58 4<br>1750682 42 30                                    | 15 175030<br>0 175066                                           | 8 8                                                                           | 1100                      | 0 1<br>P 1               | 11             |
|           |                | 5                             | 4  <br>5  <br>6   A       | Sonday<br>Friday<br>Tuesday                 | 5 April<br>26 Mar<br>15 Mar              | 12!<br>1!                        | 30<br>31<br>7 30                  | 30                           | 1751413 13 32 3<br>1751778 29 3                                     | 45 17517                                                        | 55                                                                            | 2                         | 2 1<br>3 1<br>4 1<br>5 1 | 11<br>11       |
| E         | 3              | <b>7</b><br>8                 | 7<br>8 A<br>9             | Wednes                                      | 22 Mar<br>12 Mar                         | 1<br>                            | 5 31<br>5 31                      | 1 30<br>1 30                 | 1752509 0 6<br>1752874 15 37                                        |                                                                 | 93<br>48                                                                      | <b>4</b>                  | 6 1<br>7 1<br>8 1        | 11             |
|           | 170            | 9 480<br>00                   | 1 A                       | Tuesda<br>Saturda                           | y 31 Mar<br>y 20 Mar                     |                                  | 3   30<br>2   30                  |                              |                                                                     | 45 17532<br>0 17535                                             | - 1                                                                           |                           | 9 1                      |                |

<sup>(\*)</sup> The expunged month in the 4783d year of the Califug current, fell on Agrahayan otherwise Margasiras, and the intercalated months were Aswina and Chitra, of the ensuing year.

| 1.                  | II.                           | III.                   | IV.                                         | ; V.              | VI.               |                                   | VIII                         | 1X.                                                             | X.                                                              | X1.                           | 11                                   | XII                                    | ·                |
|---------------------|-------------------------------|------------------------|---------------------------------------------|-------------------|-------------------|-----------------------------------|------------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------|--------------------------------------|----------------------------------------|------------------|
| Christian<br>years. | Years expired of the Cali yug | Character of the year. | Last feria<br>in the<br>Luni-solar<br>year, | Date of the       | Chitra<br>r year, | Sydereal dura-<br>tion of Chitra. | Civil duration<br>of Chitra. | Solar Ahargana,<br>or Yugadia,<br>to be counted from<br>Friday. | Luni-solar<br>Ahargana<br>to be<br>counted<br>from<br>Thursday. | Years of Era<br>Vicramaditya. | Tuzelee years expired.               | Imital date,                           | Initial date,    |
| 1701                | 1802                          |                        | Friday<br>Tuesday                           | 9 April<br>28 Mar | 31<br>20          | Syd.<br>31<br>31                  | 30                           |                                                                 | DAYS.<br>1753970<br>1754321                                     | 1758<br>9                     | ,                                    | July<br>1<br>1                         | July<br>12<br>12 |
| 3                   |                               | A                      | Saturday                                    |                   | 8                 | 30                                | 31                           | 1754700 33 13 45                                                |                                                                 | 1760                          | 2                                    | 1                                      | 12               |
| 4                   |                               |                        | Friday                                      | 4 April           | 27                | 30                                | 31                           |                                                                 | 1755062                                                         |                               | ∯i ដ                                 | l                                      | 12               |
| 5                   |                               |                        | Wednes                                      | 25 Mar            | 17                | 31                                | 30                           |                                                                 | 1755417                                                         | 2                             |                                      | 1                                      | 13               |
| 6                   | 1                             | A                      | Sunday                                      | 14 Mar            | 6                 | 31                                | 30                           | 1 - 1 - 1 - 1                                                   | 1755771<br>1756155                                              | 3                             | 1                                    | 2                                      | 14               |
| 7                   | 1 '                           |                        | Saturday                                    | 2 April           | 24<br>13          | 30                                | 31                           |                                                                 | 1756509                                                         | 5                             | 11                                   | l                                      | 12               |
| 8                   | 9                             | A                      | Wednes                                      | 21 Mar            |                   | 30                                | 30                           | _                                                               |                                                                 | l                             | 11                                   |                                        |                  |
|                     | 4810                          | 1                      | Monday                                      | 11 Mar            | 3                 | 31                                | 30                           | 1756892 6 21 15                                                 | 1756864                                                         | 6 7                           | t 1                                  | 1                                      | 12               |
| 17:0                |                               |                        | Saturday                                    | 29 Mar            | 20                | 30                                | 30                           | 1757257 21 52 30<br>1757622 37 23 45                            | 175 <b>724</b> 7<br>175 <b>76</b> 02                            | 8                             | 11 1                                 | ဋ                                      | 13               |
| 1                   | 2                             | A                      | Thursday                                    | 19 Mar<br>6 April | 10<br>—29         | 30                                | 31                           | 1757987 52 55 O                                                 | 1757986                                                         | 9                             |                                      | ĩ                                      | 12               |
| 3                   | . ~1                          |                        | Wednes<br>Sunday                            | 26 Mar            | -18               | 31                                | 30                           | 1758353 8 26 15                                                 | 1758340                                                         |                               |                                      | ı                                      | 12               |
| 4                   | 5                             | A                      | Thursday                                    |                   | 6                 | 30                                | 30                           |                                                                 | 1758694                                                         | 1                             | 3                                    | 1                                      | 12               |
| 5                   | 6                             | ••                     | Wednes                                      | 3 April           | 25                | 30                                | 31                           | 1                                                               | 1759078                                                         | 2                             |                                      | 2                                      | 13               |
| 6                   | 7                             | Α                      | Monday                                      | 23 Mar            | _15               | 30                                | 30                           | 1759448 55 0 0                                                  | 1759433                                                         | 3                             | 5                                    | 1                                      | 12               |
| 7                   | 8                             |                        | Friday                                      | 12 Mar            | _ 4               | 31                                | 30                           | 1759814 10 31 15                                                | 1759787                                                         | 4                             | 6                                    | 1                                      | 12               |
| 8                   | : 1                           |                        | Thursday                                    |                   | 22                | 30                                | 30                           | 1760179 26 2 30                                                 | 1760171                                                         | 5                             | 7                                    | 1                                      | 15               |
| 9                   | 1820                          | Λ                      | Tuesday                                     | 21 Mar            | 11                | 30                                | 31                           |                                                                 | 1760525                                                         | 6                             | 11 1                                 | 2                                      | 13               |
| 1720                | 1                             |                        | Saturday                                    | 9 Mar             | 1                 | 30                                | 30                           |                                                                 | 1760880                                                         | 7                             | 9                                    | 1                                      | 12               |
| 1                   | 2                             |                        | Friday                                      | 28 Mar            | _20               | 31                                | 30                           |                                                                 | 1761264                                                         | 8                             | 1130                                 | 1                                      | 12               |
| 2                   | 3                             | Α                      | Tuesday                                     | 17 Mar            | 8                 | 30                                | 30                           |                                                                 | 1761618<br>1762 <b>0</b> 02                                     | 1700                          | 1 2                                  | 2                                      | 13               |
| 3                   | 4                             | •                      | Monday                                      | 5 April           | 27                | 30                                | 31                           | 1762005 43 38 45<br>1762370 59 10 0                             | 1762356                                                         | 1/80                          | 3                                    | ĩ                                      | 12               |
| -4                  | _ 5                           |                        | Friday                                      | 24 Mar            | 16                | 30                                | 30                           |                                                                 | i                                                               | }                             |                                      |                                        |                  |
| 5                   | 6                             | A                      | Wednes                                      | 14 Mar            | _ 6               | 31                                | 30                           | 11102,00                                                        | 1762711                                                         | 2                             | 4 5                                  | 1                                      | 12               |
| 6                   | 7                             |                        | Tuesday                                     | 2 April           | 21                | 30                                | 31                           |                                                                 | 1763095<br>1763449                                              | 4                             | 6                                    | 2                                      | 13               |
| 7                   | 8                             | A                      | Saturday                                    | 22 Mar            | 13                | 30                                | 31                           |                                                                 | 1763803                                                         | 5                             | 7                                    | 1                                      | 12               |
| 8                   | 9                             | į                      | Wednesd                                     | 10 Mar            | $-\frac{2}{1}$    | 31<br>31                          | 30<br>30                     |                                                                 | 1764187                                                         | 6                             | 8                                    | 1                                      | 12               |
| 1730                | 1830                          |                        | Tuesday                                     | 29 Mar<br>19 Mar  | -21<br>10         | 30                                | 31                           | 1764562 32 17 30                                                | 1764542                                                         | 7                             | 9                                    | 1                                      | 12               |
| 1/30                | 1 2                           | A                      | Sunday                                      | 9 April           | 28                | 30                                | 31                           | 1764927 47 48 45                                                | 1764925                                                         | 11                            | 1140                                 | 2                                      | 13               |
| 2                   | 3                             |                        | Friday<br>Wednes                            | 26 Mar            | 18                | 31                                | 30                           | 1765293 3 20 0                                                  | 1765280                                                         | 9                             | 1                                    | 1                                      | 12               |
|                     |                               | <del>,</del> -¦        |                                             |                   |                   | 31                                | 30                           |                                                                 | 765634                                                          | 790                           | 2                                    | 1                                      | 12               |
| 3                   | 4                             | A                      | Sunday                                      | 15 Mar<br>3 April | 7                 | <b>3</b> 0                        | 31                           | 1766023 34 22 30 1                                              | 1766018                                                         | 1                             | ន∤                                   | 9                                      | 12               |
| 5                   | 5<br>6                        | ' <b>A</b>             | Saturday<br>Wednes                          | 23 Mar            | 14                | 30                                | 31                           | 1766388 49 53 45                                                | 766372                                                          | 5                             | 4                                    | 2                                      | 13               |
| 6                   | 7                             | A                      | Monday                                      | 12 Mar            | _ 4               | 31                                | 20                           | 1766754 5 25 011                                                | 766727                                                          | 311                           | 5                                    | 1                                      | 12               |
| 7                   | 8                             | ļ                      | Sunday                                      | 31 Mar            | 22                | 30                                | 30                           | 1767119 20 56 15 1                                              | 767465                                                          | 5                             | $\begin{bmatrix} 6\\7 \end{bmatrix}$ | $\begin{bmatrix} 1 \\ 2 \end{bmatrix}$ | 12               |
| 8                   | 9                             | A                      | Thursday                                    | 20 Mar            | 11                | 30                                | 31                           | 1767481 36 27 30 1<br>1767849 51 58 45 1                        | 767849                                                          | 6                             | ()                                   | 2                                      | 13               |
| 9                   | 1840                          | ļ                      | Wednes                                      | 8 April           | _30               | 30                                | 30°                          | 1768215 7 30 0 1                                                | 768203                                                          | 711                           | 9                                    | ī                                      | 12               |
| 174.                | 1                             | 1                      | Sunday                                      | 27 Mar            | -19               | 31                                |                              |                                                                 |                                                                 | il                            |                                      |                                        | !                |
| 1                   | 2                             | A                      | Friday                                      | 17 Mar            | 8                 | 30                                | 30                           | 1768580 23 1 15 1<br>1768945 38 <b>32</b> 30 1                  | 768558<br>768919                                                | 8]<br>9]                      | 1150                                 | 2                                      | 12               |
| 2                   | . 3                           | ĺ                      | Thursday                                    | 5 April           | 27                | 30                                | 31   30                      | 1769310 54 3 45 1                                               | 769296 1                                                        |                               | 빞                                    | 2                                      | 13               |
| 3,4                 | 4                             | 1                      | Monday                                      | 20 2.2            | -16               | 30<br>31                          | 30                           |                                                                 | 769650                                                          | 1                             | 3                                    |                                        | 12               |
| .4                  | 5 6 7                         |                        | - · · · · · ·                               | 13 Mar<br>1 April | $-\frac{5}{23}$   | 30                                | 30                           | 1770041 25 6 15/1                                               | 772034                                                          | 2                             | 4                                    | 1                                      | 12               |
| 5<br>6<br>7         | 6                             |                        | Thursday                                    | 22 Mar            | 13                | 30                                | 31                           | 1770403 40 37 30 1                                              | 770389                                                          | 3                             | 5                                    | 2                                      | 13               |
| 2                   | 8                             |                        | Tuesday  <br>Saturday                       | 11 Mar -          | _ 2]              | 30                                |                              | 1770771 56 8 45 1                                               | 770743                                                          | 4                             | 6                                    |                                        | 13               |
| 8                   | $g_1$                         |                        | Friday                                      | 29 Mar  -         | _21               | 31                                | 30 1                         | 771137 11 40 0 1                                                | 771127                                                          | 5                             | 7                                    | ,                                      | 12               |
|                     | 1850                          |                        | Tuesday                                     | 18 Mar            | 9                 | 30                                | 30   1                       | 771502 27 11 15 1                                               | 771481                                                          | 6.                            | S                                    |                                        | 12               |
| 1750                | 1                             |                        | Monday                                      | 6 April           | 28'               | 30 1                              | 1 ٰ 1 د<br>                  | 771867 42 42 30 1                                               | //1802                                                          | 7:                            | <u>91</u><br>—                       | 2 !                                    | 13               |

| ) I.                                                 | II.         | HE                    | IV.                  | V. 1                  | V1.                                       |                     | vīiī,               | IX.                                                 | X.                                          | Xol. i                      | XI.              | T.               |
|------------------------------------------------------|-------------|-----------------------|----------------------|-----------------------|-------------------------------------------|---------------------|---------------------|-----------------------------------------------------|---------------------------------------------|-----------------------------|------------------|------------------|
| 3 R                                                  | cali yng    | rter of year.         | Last feria           | Date of the last mean | Chitra<br>ir yfar.                        | al dura.<br>Chitra. | duration<br>Chitra. | Solar Ahargana,<br>or Yugadia,                      | Luni-tolar<br>Ahargana<br>to be             | ears of Kra<br>icramaditys. | c years<br>ired. | date,            |
| Christian<br>years.                                  | Vear-       | Character<br>the year | Luni-solar<br>year.  | in do.                | Date in C                                 | Syderent cion of Cl | Civil of C          | to be counted from<br>Friday,                       | from Thursday.                              | Years<br>Vicran             | Fuzelec yez      | Initial<br>N.    |
| 2                                                    | 4852<br>3   | A                     | Saturday<br>Wednes   | 27 Mar<br>15 Mar      | Syd.<br>18<br>7                           | 30<br>31            | <b>30</b><br>30     | li di di di di di di di di di di di di di           | DAYS.<br>1772220<br>1772574                 | 1 <b>SO</b> 8               | 1160<br>1,       | July<br>13<br>12 |
| 3                                                    | 4 5.        | A                     | Tuesday<br>Saturday  | 3 April<br>23 Mar     | 25.<br>15                                 | 30<br>30            | 30<br>31            |                                                     | 1772958<br>1773312                          | 1810                        | 3                | 13               |
| 5<br>6                                               | 6<br>7      |                       | Thursday             | 13 Mar                | 4                                         | 31                  | 30                  | 1773694 0 18 45                                     | 1773667                                     | 2                           | 4 5              | 13<br>12         |
| 7                                                    | 8           | A                     | Fuesday<br>Sunday    | 30 Mar<br>20 Mar      | _22<br>11                                 | 31<br>30            | 30                  | 1774421 31 21 15                                    | 1774050<br>1774405                          | 3                           | 6                | 12<br>13         |
| $-\frac{8}{9}$                                       | 9<br>1550   |                       | Saturday<br>Wednes   | 8 April<br>28 Mar     | 30                                        | 30                  | 31                  | 1774789 46 52 30<br>1775155 2 23 45                 | I <del></del>                               | <u>5</u>                    | - 7<br>8         | 13               |
| 1760                                                 | 1           | A                     | Sunday               | 16 Mar                | $\begin{bmatrix} -19 \\ -8 \end{bmatrix}$ | 31                  | 30                  | 1775520 17 55 O                                     | 177514 <b>3</b><br>1775 <b>4</b> 9 <b>7</b> | 7                           | 9                | 12               |
| 2                                                    | 2 3         |                       | Saturday<br>Thursday | 4 April<br>25 Mar     | 25<br>16                                  | 30<br>30            | 31                  |                                                     | 1775831<br>1776236                          | 8<br>9                      | 1170<br>1        | 12<br>13         |
| 3<br>4                                               | 4<br>5      | A                     | Monday<br>Sunday     | 14 Mar<br>1 April     | 5.<br>21                                  | 31<br>31            | 30                  |                                                     | 1776590<br>1776974                          | 18 <b>2</b> 0               | 2<br>3           | 13<br>12         |
| 5<br>6                                               | 6           | A                     | Thursday             | 21 Mar                | 12                                        | 30                  | 31.                 | 1777346 35 31 15                                    | 1777328                                     | 2                           | 4                | 13               |
| 7                                                    | '8          |                       | Tuesday<br>Monday    | 11 Mar<br>30 Mar      | $\frac{-2}{-21}$                          | 30                  | 30                  |                                                     | 1777683                                     | $-\frac{3}{4!}$             | - 5<br>6         | 13               |
| 8                                                    | 9           | A                     | Friday               | 18 Mar                | 9                                         | 30                  | 30                  | 1778442 22 5 0                                      | 1778067<br>1778421                          | 5                           | 7                | 12               |
| 1 <b>7</b> 70                                        | 4870<br>1   |                       | Thursday<br>Monday   | 6 April<br>26 Mar     | 28<br>—17                                 | 30                  | 31 30               |                                                     | 1778805<br>1779159                          | 6                           | 8<br>9           | 13<br>13         |
| $\begin{array}{cccccccccccccccccccccccccccccccccccc$ | 2<br>3      | A                     | Saturday<br>Friday   | 16 Mar.<br>3 April    | 7<br>25                                   | 31<br>30            | 30<br>30            | 1779538 8 38 45                                     | 1779514<br>1779898                          | 8                           | 1180<br>1        | 13<br>12         |
| 3<br>4                                               | 4<br>5      | A                     | Tuesday<br>Saturday  | 23 Mar<br>12 Mar      | 14<br>3                                   | 30                  | 31 30               | 1780268 39 41 15<br>1780633, 55 12 30               | 1780252                                     | - 1                         | 2                | 13<br>13         |
| 5                                                    | 6           |                       | Friday               | 31 Mar                | 22                                        | 31                  | 30                  |                                                     | 1780990                                     | 2                           | 4                | 13               |
| 6 7                                                  | 7<br>8      | Α                     | Wednes<br>Monday     | 20 Mar<br>7 April     | 14<br>29                                  | 30<br>30            | 30<br>31            |                                                     | 1781345<br>1781728                          | 3                           | 5                | 12<br>13         |
| 8                                                    | 9<br>4880   | A                     | Saturday<br>Wednes   | 28 Mar<br>17 Mar      | 19                                        | 30                  | 30                  | 1782094 57 17 30                                    | 1782083                                     | 5                           | 7<br>8           | 13<br>13         |
| 1780                                                 | 1           | А                     | Tuesday              | 4 April               | - 8<br>26                                 | 31<br>30            | 30                  | 1782460 12 48 45<br>1782825 28 20 0                 | 1782437<br>1782821                          | 6<br>7                      | 9                | 12               |
| 1 2                                                  | 2 3         | A                     | Saturday<br>Thursday | 24 Mar<br>14 Mar      | 15                                        | 30                  | 31<br>30            | 1783190 43 51 15<br>1783555 59 22 30                | 1783175<br>1783530                          | 8<br>9                      | 1190<br>1        | 13               |
| 3                                                    | 4           |                       | Wednes               | 2 April               | 24                                        | 31                  | 30                  | 1783921 14 53 45                                    | 1783914                                     | !1                          | 2                | 13               |
| 5                                                    | 1           | A                     | Sunday<br>Thursday   | 21 Mar<br>10 Mar      | 12<br>1                                   | 30                  | 31                  | 1784286 30 25 O                                     | 1784268<br>1784622                          |                             | 3<br>4           | 12<br>13         |
| 6                                                    | 7           | A                     | Wednes               | 29 Mar                | 20                                        | 31                  | 30                  | 1785017 1 27 30                                     | 1785006                                     | 3                           | 5                | 13               |
| \ 8                                                  | 9           |                       | Monday<br>Sunday     | 19 Mar<br>6 April     | 10<br>28                                  | 31<br>30            | 30                  | 1785382 16 58 45<br>1785747 32 30 0                 | 178536!<br>1785745                          | 4<br>5                      | 7                | 12               |
| 1790                                                 | 4890 1      |                       | Thursday<br>Monday   | 26 Mar<br>15 Mar      | 17<br>6                                   | 30<br>31.           | 31<br>30            | 1786112 48 1 15<br>1786478 3 3 <b>2</b> 30          | 1786099                                     | 6                           | 8 9              |                  |
| 1 :                                                  | 2 3         | Λ                     | Sunday<br>Friday     | 3 April               | _25                                       | 31                  | 30                  | 1786843 19 3 45                                     | 1786837                                     | 8                           | 1200             | 13<br>13         |
|                                                      | 3; 4<br>4 5 |                       | Tuesday              | 23 Mar<br>12 Mar      | 14<br>3                                   | 30<br>30            | 31                  | 1787208 34 35 0<br>1787573 50 16 15                 | 1787192<br>1787546                          |                             | $\frac{1}{2}$    | 13               |
| 1 .                                                  | 5  6        | A                     | Monday<br>Eriday     | 31 Mar<br>20 Mar      |                                           |                     | 30<br>30            | 1787939 5 37 30                                     |                                             | 1                           | 3                |                  |
| ,                                                    | 6 7<br>7 8  | 3                     | and Stiav.           | 7 April<br>28 Mar     | 29                                        | 30                  | 31                  | 1788669 36 40 0                                     | 1788668                                     | 3                           | 5                | 13               |
|                                                      | 8           | r                     | Saturday<br>Friday   | 17 Mar                | 19<br>- 8                                 | 31                  | 30<br>30            | 1789034 52 <b>11 15</b><br>  1789400 <b>7 42 30</b> |                                             |                             | 7                | 13               |
| 180                                                  |             |                       | Tuesday              | 5 April<br>25 Mar     | 26<br>15                                  |                     |                     | 1789765 23 13 45                                    |                                             | 6                           | 8 9              |                  |

| <del>ر -</del>      |                               |                        | . 755                                       |                                                   |                                                                  |                 |                           | ible, continued.                                               |                             |                            |                        |               |
|---------------------|-------------------------------|------------------------|---------------------------------------------|---------------------------------------------------|------------------------------------------------------------------|-----------------|---------------------------|----------------------------------------------------------------|-----------------------------|----------------------------|------------------------|---------------|
| T.                  |                               | 111.                   | IV.                                         |                                                   | $\left  \frac{\mathbf{V}\mathbf{I}_{r}}{\mathbf{I}_{r}} \right $ | VII.            | VIII                      | IX.                                                            | I i -                       | XI.                        | X                      | 11.           |
| Christian<br>years. | Years expired of the Cali yag | Character of the year. | Last feria<br>in the<br>Luni-solar<br>year. | Date of the<br>last mean<br>conjunction<br>in do. | Date in Cl                                                       | Sydered dura-   | Civil duration of Chitra, | Selar Ahargana,<br>or Yugada,<br>to be counted from<br>Friday. | to be                       | Vieramaditya.              | Fuzelog years expired. | Initial date, |
|                     | 4932                          | Λ                      | Sunday                                      | 15 Mar                                            | Syd.<br>2 5                                                      | 30              | 30                        | BAVS. G. V. P.<br>1790495 54 16 15                             | BAYS.<br>1790470 1          |                            | 1210                   | July<br>14    |
| 2 3                 | 3 4                           | $\mathbf{A}$           | Friday<br>Wednes                            | 2 April<br>23 Mar                                 | 23<br>12                                                         | 31              | 30                        | 1790861                                                        | 1790853                     | 13                         | 1                      | 1.1           |
| 4                   | 5                             | A                      | Sunday                                      | 11 Mar                                            | 1 1                                                              | 30              | 31                        | <b>!</b>                                                       | 1791208 1<br>179156         | 860 <sub>∏</sub><br>11     | 2                      | 14            |
| 5                   | 6                             |                        | Saturday                                    | 30 Mar                                            | _20                                                              | 30              | 30                        | 1791956 56 21 15                                               | 1791946                     | 2                          | 4                      | 14            |
| 6                   | 7                             | A                      | Wednes                                      | 19 Mar                                            | - 6                                                              | 31              | 30                        |                                                                | 1792.00                     | 3                          | 5                      | 14            |
| 8                   | 8<br>9                        |                        | Tuesday                                     | 7 April<br>27 Mar                                 | 27                                                               | 30              | 30                        | 1792687 27 23 45<br>1793052 42 55 0                            | 1792684<br>1793039          | 4<br>5                     | 6                      | 14            |
| !                   | !                             | ·                      | Sunday                                      | ·                                                 | 17                                                               | <del> </del>    | -                         |                                                                |                             | i                          | 7                      | 14            |
| 1910                |                               |                        | Thursday<br>Wednes                          | 16 Mar<br>4 April                                 | $\begin{bmatrix} -6 \\ -25 \end{bmatrix}$                        | 30<br>31        | 30                        | 1793417 58 26 15<br>1793783 13 57 30                           | 1793363                     | 6H<br>7                    | 8                      | 11            |
| 1910                |                               | 1                      | Sunday                                      | 24 Mar                                            | 13                                                               | 30              | 30                        |                                                                | 1793///                     |                            | 1220                   | 14            |
| 2                   |                               |                        | Friday                                      | 13 Mar                                            | 3                                                                | 30              | 31                        |                                                                | 1794486                     | 9]                         | 1                      | 14            |
| 3                   |                               |                        | Thursday                                    | 1 April                                           | _22                                                              | 31              | 30                        |                                                                | 1794870 1                   |                            | 2!                     | 11            |
| 4                   |                               |                        | Monday                                      | 21 Mar                                            | 11                                                               | 31              | 30                        |                                                                | 1795224                     | - 111<br>- 61              | 3                      | 11            |
| 5                   |                               |                        | Sunday<br>Thursday                          | 9 April                                           | 29<br>18                                                         | 30<br>30        | 31                        | 1795609 31 33 45<br>1795974 47 5 0                             | i I                         | 2<br>3                     | 4                      | 11            |
| 6                   | l                             | l                      | ·                                           |                                                   | ·i                                                               |                 | ·                         |                                                                |                             | — j!                       |                        |               |
| 7                   |                               |                        | Tuesday                                     | 18 Mar                                            | -8                                                               | 31              | 33                        |                                                                | 1796317<br>1796700          | - Jij<br>- 5'i             | 7                      | 14            |
| 8 9                 | 1                             |                        | Sunday<br>Friday                            | 5 April                                           | -26<br>15                                                        | 31              | 31                        |                                                                | 1797055                     | 6                          | 8                      | 15            |
| 1820                |                               |                        | l'Tuesday                                   | 14 Mar                                            | 4                                                                | 30              | 31                        | 1797435 49 10 6                                                | 1797409                     | 7                          | 9                      | 14            |
| 1020                |                               |                        | Monday                                      | 2 April                                           | _23                                                              |                 | 30                        |                                                                | 1797793                     | - 1                        | 1230]                  | 11            |
| 2                   | 3                             |                        | Saturday                                    | 23 Mar                                            | 13                                                               |                 | 30                        |                                                                | 17981 18                    | (19                        | 1;                     | 14            |
| ,3<br>'4            | 4                             |                        |                                             | 12 Mar                                            | 1                                                                | 30              | 31                        | 1793531 35 43 45<br>1793896 51 15 0                            | 1798502 18<br>1798886       | 850. <sub> </sub><br>  1:1 | $\frac{2}{3}$          | 15<br>14      |
| 4                   | 5                             | İ                      | Tuesday.                                    | 30 Mar                                            | 20                                                               | 30              | 31                        |                                                                |                             |                            |                        | !             |
| 5                   | 6                             | A                      | Saturday                                    | 19 Mar                                            | 9                                                                | 31              | 30                        |                                                                | 1799240<br>17 <b>9</b> 9624 | 2                          | 5                      | 11            |
| 6                   |                               |                        | Friday                                      | 7 April<br>27 Mar                                 | 27                                                               | 30              | 30                        |                                                                | 1799978                     | 4                          | 6                      | 15            |
| 7                   |                               |                        | Tuesday<br>Sunday                           | 27 Mar<br>16 Mar                                  | 6                                                                |                 |                           |                                                                | 1800333                     | 5                          | 7                      | 14            |
| 8 9                 | 1                             | J.                     | Siturday                                    | 4 April                                           | 25                                                               | 31              | 30                        | 10000                                                          | 1800717                     | 61                         | $ \mathbf{s} $         | 14            |
| 1830                |                               | • .                    | Wednes                                      | 24 Mar                                            | 13                                                               | 30              |                           | 180108 <b>8</b> 24 22 30<br>1801453 39 53 45                   | 1801071                     | 8.1                        | 1210                   | 14            |
| 1                   | 2                             |                        | Sunday                                      | 13 Mar                                            | 2                                                                | 30              | 31 30                     |                                                                | 1801425                     | 0                          | 1                      | 15            |
| 2                   |                               |                        | Saturday                                    | 31 Mar                                            | 21                                                               | 30              |                           |                                                                |                             | _ 1}-                      |                        | <u>!</u>      |
| 3                   |                               |                        | Thursday                                    | 21 Mar                                            | -11                                                              | 31              | 30<br>30                  | 18021S4 10 56 15<br>1802549 26 27 30                           | 1802104 13                  | 1                          | 21                     | 14            |
| 4                   |                               |                        | Wednes                                      | 9 April<br>29 Mar                                 | 29                                                               | <b>30</b><br>50 | 31                        | 1802914 41 58 45                                               | 1802902                     | 2                          | 41                     | 15            |
| 5                   |                               | A                      | Sunday<br>Thursday                          | 17 Mar                                            | 7                                                                | 30              | 30                        | 1803279 57 30 0                                                | 1803256                     | 3                          | 5                      | 11            |
| 6 7                 |                               |                        | Wednes                                      | 5 April                                           | 26                                                               | 31              | 30                        | 1803645 13 1 15]                                               | 18036 10                    | 4                          | 6                      | 14            |
| 3                   |                               |                        | Monday                                      | 26 Mar                                            | 15                                                               | <b>3</b> 0      |                           | 1804010 23 32 30<br>1804375 44 3 45                            | 1803995                     | 5                          | 7  <br>8               | 14<br>15      |
| 9                   | 4940                          |                        | Friday                                      | 15 Mar                                            | 23                                                               | 30<br>30        | 31<br>30                  |                                                                | 1804733                     | 7                          | 9                      | 13            |
| 1840                |                               | *                      | Thursday                                    | 2 April                                           | i![                                                              |                 |                           |                                                                | 1805097                     | !!                         |                        |               |
| 1                   | 2                             |                        | Monday                                      | 22 Mar                                            | 12<br>1                                                          | 31              | 30                        | 1805106                                                        |                             | 5                          | .250<br>1              | 14            |
| 2                   |                               | 1                      | Saturday                                    | 12 Mar                                            | 19)                                                              | 30<br>30        |                           |                                                                | 1805825 19                  |                            |                        | 15            |
|                     | 4                             |                        | Thursday<br>Tuesday                         | 30. Mar<br>19 Mar                                 | 9                                                                | 31              | 30 1                      | 806202 1 40 0                                                  | 1806180                     | 1                          | 3                      | 14            |
| 4                   | 1 -                           | A                      | Monday                                      | 7 April                                           | _23                                                              |                 |                           | 806567 17 11 15 1                                              |                             | 9                          | ,                      | 14            |
| 6                   |                               |                        | Friday                                      | 27 Mar                                            | 16                                                               | 30              |                           | \$06932 <b>32 1</b> 2 30 1<br>807297 <b>48 13 4</b> 5 1        |                             | 3 +                        | $\frac{5}{6!}$         | 14            |
| 7                   |                               |                        | Tuesday                                     | 16 Mar                                            | 5<br>24                                                          | 30              |                           |                                                                | (807272)<br>(807856)        | 4]<br>5]                   | . 1                    | 11            |
| 8                   | 9                             |                        | Monday                                      | 3 April                                           |                                                                  | 31              |                           | 808028 19 16 15 1                                              |                             | $G_{A}^{\dagger}$          |                        | 14            |
| 9                   | 4950                          |                        | Saturday<br>Wednes                          | 18 Mar                                            | 2                                                                | 30              | 31.1                      | 808393 34 47 30.1                                              | ასგ305)                     | 711                        |                        | 15            |
| 1850                | 1                             | A                      | weanes :                                    |                                                   |                                                                  | - '-            | ·                         |                                                                |                             | •                          | -                      | . 1           |

<sup>(\*)</sup> The month which is expunged is Agrabayan or Mugueiras. Those which are repeated are Assana, and Changa the first of the ensuing year.

Second Chronological Table, continued.

| I.                  | 11.                           | 111.                   | 1 V.                                        | V. 1                                              | VI.                                                | <del></del>                     | VIII                       | IX.                                                             | X.                                                              | XI.                           | XI                        | 1.                     |
|---------------------|-------------------------------|------------------------|---------------------------------------------|---------------------------------------------------|----------------------------------------------------|---------------------------------|----------------------------|-----------------------------------------------------------------|-----------------------------------------------------------------|-------------------------------|---------------------------|------------------------|
| Christian<br>years. | Years expired of the Cali yug | Character of the year. | Last feria<br>in the<br>Luni-solar<br>year. | Date of the<br>last mean<br>conjunction<br>in do. | Date in Chitta<br>of Solar year.                   | Syderenldma-<br>tion of Chitra. | Civil duration of Chitra.  | Solar Abargana,<br>or Yugadia,<br>to be counted from<br>Friday. | Luni-solar<br>Ahargana<br>to be<br>counted<br>from<br>Thursday. | Years of Era<br>Vicramaditya. | Fuzelce years<br>expired. | Initial date, N. S.    |
| 1851<br>2<br>3      | 4952<br>3<br>4                | A                      | Tuesday<br>Saturday<br>Friday               | 1 April<br>20 Mar<br>8 April                      | Syd.<br>21<br>-10<br>28                            | 30<br>31<br>30°                 | 31<br>30<br>30             | 1809124 5 50 0<br>1809489 21 21 15                              | DAYS,<br>1808749<br>1809103<br>1809487                          | 9                             | 1 2                       | July<br>15<br>14<br>14 |
| 4<br>5<br>6<br>7    | 5<br>6<br>7<br>8              | A<br>A                 | Wednes<br>Sunday<br>Saturday<br>Wednes      | 29 Mar<br>18 Mar<br>5 April<br>25 Mar             | 18<br>  7<br> 26<br>  14                           | 30<br>30<br>31<br>30            | 31<br>30<br>30<br>30       | 1810219 52 23 45<br>1810585 7 55 0                              | 1809842<br>1810196<br>1810580<br>1810934                        | 1<br>2<br>3<br>4              |                           | 15<br>15<br>14<br>14   |
| 9<br>1860           | 9<br>1960<br>1                | A                      | Monday<br>Sunday<br>Thursday                | 15 Mar<br>3 April<br>22 Mar                       | -4<br>-23<br>-12                                   | 30<br>30<br>31                  | 31<br>30<br>30             | 1811315 38 57 30<br>1811680 54 28 45<br>1812046 10 0 0          | 1812027                                                         | 5<br>6<br>7                   | 5<br>9<br>1270            | 15<br>15<br>14<br>14   |
| 1<br>2<br>3<br>4    | 2<br>3<br>4<br>5              | A                      | Wednes<br>Sunday<br>Friday<br>Wednes        | 10 April<br>30 Mar<br>20 Mar<br>6 April           | 30<br>19<br>— 9<br>—27                             | 30<br>30<br>30<br>31            | 30<br>31<br>30<br>30<br>30 | 1812776 41 2 30<br>1813141 56 33 45<br>1813507 12 5 0           | 1812411<br>1812765<br>1813120<br>1813503<br>1813858             | 9                             | 1 2 3 4                   | 15<br>15<br>.14        |
| 5<br>6<br>7<br>8    | $-\frac{6}{7}$ $-\frac{8}{9}$ | A                      | Monday<br>Friday<br>Thursday<br>Monday      | 23 Mar                                            | 16<br>5<br>-24<br>-13                              | 30<br>30<br>30<br>31            | 31<br>30<br>30             | 1814237 43 7 30<br>1814602 58 38 45                             | 1814212                                                         | · 3                           | 5<br>6<br>7               | 15<br>15<br>14         |
| 1870<br>1<br>2      | 4970<br>1<br>2<br>3           | A                      | Saturday<br>Friday<br>Tuesday<br>Monday     | 13 Mar<br>1 April<br>21 Mar<br>8 April            | 21<br>21<br>-10<br>-29                             | 30<br>30<br>31<br>31            | 30<br>31<br>30<br>30       | 1816064 0 43 45<br>1816429 16 15 0                              | 1815689<br>1816048<br>1816427                                   | 7<br>8<br>9                   | 9<br>1280<br>1            | 14<br>15<br>15<br>14   |
| 3<br>4<br>5         | -6                            | A                      | Friday<br>Wednes<br>Tuesday                 | 28 Mar<br>18 Mar<br>6 April                       | 17<br>7<br>—26                                     | 30<br>30<br>31<br>31            | 31 30 30                   |                                                                 | 1817136<br>1817520                                              | 1 2                           | . 4                       | 11<br>15<br>15<br>14   |
| 6<br>7<br>8<br>9    | 8<br>9<br>4980                | A                      | Saturday<br>Wednes<br>Tuesday<br>Sunday     | 25 Mar<br>14 Mar<br>2 April<br>23 Mar             | 15<br>3<br>22<br>12                                | 30<br>30<br>31                  | 30<br>31<br>31<br>30       | 1818255 33 51 15<br>1818620 49 22 30<br>1818986 4 53 45         | 1818612<br>1818967                                              | 4<br>5<br>6                   | 6<br>7<br>8               | 15<br>15<br>15         |
| 1880                | 3                             | A                      | Saturday<br>Wednes<br>Sunday<br>Saturday    | 10 April<br>30 Mar<br>19 Mar<br>7 April           | $ \begin{array}{r} 30 \\ 19 \\8 \\27 \end{array} $ | 30                              | 30<br>31<br>30<br>30       | 1819716 35 56 15<br>1820081 51 27 30                            | 1819351<br>1819705<br>1820039<br>1820443                        | 8                             | 1                         | 14<br>15<br>15<br>15   |
| 4                   | 5 6                           | i A                    | Thursday<br>Monday<br>Sunday                | 27 Mar<br>16 Mar<br>4 April                       | 16<br>5<br>—24<br>—13                              | 30<br>30<br>30                  | 30<br>31<br>30<br>30       | 1820812 22 30 0<br>1821177 38 1 15<br>1821542 53 22 30          | 1820798<br>18 <b>2</b> 1152                                     | 1<br>2<br>3                   | 3<br>4<br>5               | 14<br>15<br>15         |
| 189                 | 8' 9<br>9 199<br>0            | 0<br>1 A               | Tuesday<br>Sunday<br>Friday                 | 13 Mar<br>31 Mar<br>21 Mar                        | 20<br>20<br>-10                                    | 30<br>30<br>30                  | 30<br>31<br>30             | 1822273 24 35 0<br>1822638 40 16 15<br>1823003 55 37 30         | 1822245<br>182 <b>2</b> 628<br>1822983                          | 5 6 7                         | 7<br>8<br>9               | 14<br>.15<br>15        |
|                     | 5 4                           | 5l                     | Thursday<br>Monday<br>Saturday<br>Thursday  | 28 Mar<br>17 Mar<br>5 April                       | 17<br>6<br>—25                                     | 30<br>30<br>30                  | 30<br>31<br>30             | 1823734 26 40 (1824099 42 11 15 1824464 \$7 42 30               | 182407 <i>5</i><br>1824459                                      | 9<br>1950<br>1                | 2 3                       | 15.                    |
| 1                   | 6                             | 7 8 9 A                | Friday<br>LaTuesday                         | 14 Mar<br>2 April                                 | 29                                                 | 30<br>30<br>30                  | 30<br>31<br>30             | 1825560 44 16 15<br>1825925 59 37 30                            | 1825168<br>1825552<br>1825906                                   | 3<br>4<br>5                   | 5<br>6<br>7               | 14<br>15<br>15         |
| 190                 |                               | 1                      | Saturday                                    | 31 Mar                                            |                                                    | 31<br>30                        |                            | 1826291 15 18 43<br>1826656 30 50                               | 1826290<br>1826645                                              | 6 7                           |                           | ,                      |

### NOTE

## On the XIIth Column of the Second Chronological Tuble.

In the account which I have given of the Second Chronological Table, at page x of the Introduction, I was under the necessity of postponing what I had to say on the Carnatic Fuzelee, or Revenue year, for want of sufficient information on the subject. The cause of my hesitation arose principally from observing a difference of three years between the Bengal and Carnatic mode of reckoning in Revenue affairs, which (considering that the Fuzelee Æra was introduced in both countries by the Mahommedan government) appeared to me to originate rather with some error in the sources of my information, than from a deliberate intention on the part of those who originally instituted it in the Mogul Empire.

After some research into the subject, I regret, however, to state that the results went only to establish the fact, without explaining the occasion of the difference. The reader must therefore remain satisfied with the following imperfect account of the Revenue periods observed in this part of India.

The Carnatic Fuzelee year is a Solar one, and its construction is exactly the same as that of the Tamul Saura Mana, being of 365° 15° 31° 15°, with this only difference, that instead of beginning with the 1st of the Solar month Chaitram (B. Vaisacha) it was ordained by the Mahommedan government, to commence on the 1st of Audi (B. Sravana), and as it only applies to Revenue affairs, the Civil year alone is considered in accounts.

Thus the Fuzelee year which begins on the 1st Audi of the 4927th of the Cali yug (1748th Saca) answering to the 1235th of that Era, when referred to the European Kalendar, is found to commence on the 14th July 1825.

But we have seen at page ix of the Introduction that the Bengal corresponding Revenue year was the 1232d, and that it began with the Moon's Wane in the month of Askar (Vanual Auni), (\*). Hence the difference between the two accounts, amounts to two years, eleven months and some days; which difference may possibly proceed from some unknown cause, similar to that which has occasioned the discrepancy between the manner of counting the years of Juliter (Frinspats Chacra) in Bongal, and in the Peninsula.

<sup>(\*)</sup> How the Bengel Fazelee year, being a Solar one, can be made to begin, in succession, where you me Moon's change tak in it pleasure in twelve consecutive Lunar Synodical months, was not explained to act. If there was any mistake in the present referred to, it can only be rectified in Bengal,

### XXXIV

But an innovation has occurred in the Carnatic, which (speaking as a Chronologer) I feel bound to predict, will create more confusion in the accounts of remote times, than the difference already adverted to. The Government of Fort St. George, taking probably the average Epoch of the beginning of the Mahommedan Fuzelee year (the same as that of the Tamul month Audi) for a great number of years and finding it to correspond with the 12th July, has directed its servants (with a view to greater regularity in revenue accounts) to fix in future the commencement of the Fuzelee year, on the above European date; so that agreeably to this arrangement, the Revenue is precisely equal to the European Civil year.

However, on casting a glance over the XIIth column under consideration, it will be immediately perceived that from A. D. 1600 to 1900 there is a difference of no less than five days, between the true and assumed beginning of the Fuzelee year, which will go on increasing at the rate of about two days in 120 Gregorian years, without there existing any periodical cause that might restore hereafter the supposed coincidence. A new Æra, which can be neither Indian, Mahommedan, nor Christian, will, therefore, be insensibly introduced, to perplex future Chronologers, who (excepting perhaps those who may chance to reside then under the Presidency of Fort St. George) will be unable to trace the institution to its true origin.

I am well informed that the inhabitants of these parts of India, although they do not object to the change ordered by Government when transacting with the Collectors, yet among themselves continue to abide by their old Fuzelee Kalendar; I conclude therefore, that when a change was found decidedly advisable, it would have been preferable to have adopted at once the 1st of January, instead of the 13th of July of the European year, because it would have prevented ambiguity; for call the present official Revenue year by any name that you please, it can never be any thing else, but an European account of time, disguised under a foreign name.

On the manner in which the Fuzelee years are registered in the XIIth column, I have only to repeat what I have said on the other accounts of time exhibited in these Tables; that is to say, that the numeral of the year, registered on a line with any Christian year inserted in the Ist column on the left, indicates that which expires on the day and month inserted in the second division of the XIIth column; observing that from A. D. 1600 to 1750 the beginning of the Fuzelee years is given both in Old and New Styles; and from 1750 to 1900 in New Style only.

Thus the Revenue year which ends on the 1st July O. S., and 12th July N. S. of the Christian year 1701, is the 1110th, and from that date to the end of the European year it is the 1111th.

And that which ends on the 14th July N. S. of the Christian year 1825 is the 1234th, and that which begins on the said date is the 1235th.

N. B.—As the Fuzelee year is never used but for revenue purposes, the Natives only mind its beginning, but never care for its subdivisions into months, days, &c.

FENERAL CHRONOLOGICAL TABLE exhibiting the years of the Hejira from Anno 1 to 1318, concurrent with the Christian years from A. D. 622 to 1900, and the date on which every Mahommedan year begins according to the European Kalendurs of the Julian and Gregorian Styles.

16th July A. D. 622. according to most Arabian Astronomers 15th July do. HEJIRA, according to Vulgar account

> rom Anno Domini 622 to 700, Julian Style. From Anno Heiiræ 1 to 81.

From Anno Cali yugam 3723 to 3801. 11 July 28 July 23 May Begin. Hejiræ 9June 2May #Satur. 7. Avul Haftah. 30 Nov Sep 25 Feb 15 Apr 23 Oct 18 Jan 4 From Anno 544 to 622 Saca, 655 658 697 685 642 678 686 694 Ä 650 663 671 · 59 B 67 B 75 35 B 43 B B Hejiræ Anno \* 30 Ť 51 16 Dec 14 Nov 3 Vug 20 Sep 25June 30 May Begin-ning A. 16 July 20 Apr 7 May Hejira 9 Feb 23 Jan Oct 13 Mar 6. Jummah. 28 645 658 a 673 689 630 638 199 999 699 681 269 Ą. Friday 62 B 70 B 78 B 2 II. jiræ 2 Anno 46 **-** 0 17 25 70 33 43 18 Aug 18 July 23 May Wedn. 4. Char Shumbol. | Thur. 5. Jummah Rhaut. 18 Mar 4 Apr 26 Feb Begin. ning A. 13June 13 Oct Hejiræ 2 Jan 21 Dec 25 Sep 30June 3 Jan 27 Dec 6 10 Ö. 625 633 656 684 289 692 700 Ä 65 B 68 73 B 81 B Hejiræ 20.5 52.5 53.2 19,1 09 124 28 VIICH CENTURY Begin. 11 May €4 Aug 29 May 3 Mar 21 Apr 20 Mar 19 Nov 6 Dec Hejiræ 15June 14 Fcb  $10 \mathrm{Sep}$ 698 698 690 A. D. 628 643 685 651 659299 67.4 7 B 15 71 76 B 79 ||Hejiræ| Anno 23 39 55 63 31 Begin. ning A. Hejiræ 5 July 8 Aug 26 Apr 3 Nov 9 Api 22 July 13 May 2 Jan 29 Jan 17 Oct Mungul. ₹99 685 693 029 ä 633 646 654219 623 œ. ż Tuesday Hejiræ 2 S B S B S 26 B B Anno 80 45 50 58 66 74 ning A. | Hejiræ 7 Mar 14 Sep | 3 Jan 27 Dec 6 July 10 Apı 1 May 1 Oct 10 Dec 19June 2June 24 Mar Begin. 2. Peer. \$672**}** A. D. 649 657 626 629 665 089 989 696 634 641 Monday 8 n n Hejira, Hejira 52.5 53.2 Anno 133 37 45 500 5 69 77 30 Aug 2 Feb 7 Nov 7 Oct 12 Aug 17 May 4June ning A. 21June 29 Mar 2 Jan 20 Feb 25 Nov 9 Mar 21 Dec Begin. Sunday 1. Etwar. 675 21.9 655 099 683 A. D. 624 635 691 637 641 21 B 27 B 32 B 3 II.jinæ Anno 19.1 48 56 72 80 16 9

N. B. - The Letter Bannexed to any year of the Hejira indicates that it is an intercalary one. And the Asterisk \* and stroke below, that it is the lust of the Cycle of 20 years. The years Cali yug and Saca are those about to end.

Tim Table is the first referred to in the Memoir on the Lunar year of the Mahommedane; the IVth of the Kala Sankalita,

Third Chronological Table, continued.

| ХX                                    |                                                                  | <br>      | in.<br>A.                   | 4 Feb           | 9 Nov      | 14 Aug<br>19 May  | Feb          | Nov            | Aug      | July       | June     | 11 Apr<br>10 Mar | Jan             | 19 Oct   | 24 July  | 28 Apr<br>1 Fcb  |
|---------------------------------------|------------------------------------------------------------------|-----------|-----------------------------|-----------------|------------|-------------------|--------------|----------------|----------|------------|----------|------------------|-----------------|----------|----------|------------------|
|                                       | From Anno Cali yugam 3802 to 3901,<br>From Anno C23 to 722 Saca, | ay 7.     | Begin.<br>ning A.<br>Hejiræ | 702   4 F       | 709 9 1    | 717 147           | 733 21 1     | 740 26         | 748 31   | 753 7.     | 756 53   | 761 11 764 10    | _ <u>=</u>      | 776 119  | 784 24.  | 792 28<br>800 1  |
|                                       | From Anno Cali yugam 3809<br>From Anno 623 to 722 Saca.          | Saturday  | no A. D.                    | 83              |            | <u></u>           |              |                |          | 136 B 7    |          | 144 B 7          | <del>-</del> =- | 160 B    | 168'BJ 7 | 176 B 7          |
|                                       | Cali y                                                           | =         | Anno<br>e Hejira            | =               | t    91    |                   | n 115        | ıt    123      | ly   131 |            | ь    139 |                  |                 | <u> </u> |          | ==               |
|                                       | n Anno                                                           | 6.        | Begin-<br>ning A.<br>Hejiræ | 23 Dec          | 7 Oct      | 12 July<br>16 Apr | 20 Jan       | 25 Oct         | 30 July  | 4 May      | 6 Feb    | 11 Nov           |                 | 27 Man   |          |                  |
|                                       | Fron                                                             | Friday    | A. D.                       | \$202 <b>\$</b> | 712        | 720<br>728        | 736          | 743            | 751      | 759        | 767      | 774              |                 | 795      |          |                  |
|                                       | •                                                                |           | Anno<br>Hejiræ              | 86B.6<br>87.4   | 94         | 102               | 118          | 126            | 134      | 142        | 150      | 158              |                 | 179 B    |          |                  |
|                                       | -                                                                | ž.        | Begin.<br>ning A<br>Hejiræ  | 1 Dec           | 1 5 Sep    | 10June<br>15 Mar  | 13 Dec       | 22 Sep         | 27June   | 2 Apr      | 4 Jan    | 13 Dec           | 15 Aug          | 14 July  | 20 May   | 18 Apr<br>22 Feb |
|                                       |                                                                  | Thursday  | A. D.                       | 707             | 715        | 723               | 738          | 746            | 754      | 762        | \$220    | 77.              |                 | 785      | 290      | 793              |
| tinued.                               |                                                                  | <b>E</b>  | Anno<br>Hejiræ              | 89 B            | 97 B       | 105               | 121          | 129            | 137      | 145        | 153.5    | 155 B            | 166 B           | 169      | 174 B    | 177<br>182 B     |
| Third Chronological Table, continued. | JRY.                                                             | 4.        | Begin-<br>ning A.<br>Hejiræ | 24 Jan          | 2 Jan      | 29 Oct<br>3 Aug   | 8 May        | 10 Feb         | 15 Nov   | 20 Aug     | 25 May   | 27 Feb           | dos 9           | 11June   | 16 Mar   |                  |
| gical Ta                              | CENTL                                                            | Wednesday | A. D.                       | 703             | ₹705<br>\$ | 710               | 726          | 734            | 741      | 749        | 757      | 765              | 280             | 788      | 296      | •                |
| hronolog                              | VIIII CENTURY.                                                   | 1         | Anno                        | 84 B            | 86B6       | 92 B<br>100 B     | 108 B        | 116 B          | 194      | 132        | 140      | 148              | 164             | 172      | 180      |                  |
| Third C                               |                                                                  | 6         | Begin.<br>ning A.<br>Hejiræ | 15 Feb          | 20 Nov     | 26 Sep<br>25 Aug  | 1 July       | 5 Apr          | 8 Jan    | 744 13 Oct | is July  | 22 Apr           | 31 Oct          | δ Λuρ    | 10 May   | 12 Feb           |
|                                       |                                                                  | Tuesday   | A. D.                       | 701             | 708        | 713<br>716        | 721          | 729            | \$737\$  |            | 752      | 092              | 777             | 783      | 791      | 799              |
|                                       |                                                                  | T         | Anno<br>Hejiræ              | . 65            | *<br>*     | 95 B              | 103 B        |                | 1198.3   | 127.B      | 135      | 113              | 159             | 167      | 175      | 183              |
|                                       |                                                                  |           | Begin.<br>ning A.<br>Hejiræ | 14 Jan          | 19 Oct     | 24 July<br>29 May | 28 Apr       | 3 Mar          | 31 Jan   | 7 Dec      | 11 Sep   | 16June           | .,,,            | 28 Sep   | 3 July   | 7 Apr            |
|                                       |                                                                  | Monday 2. | A. D.                       | 704             | 711        | 719               | 727          | 732            | 735      | 739        | 747      | 755              | \$770 <b>}</b>  | 778      | 286      | 794              |
|                                       | 181.                                                             | N         | Anno                        | 85              | 93         | 101<br>106 B      | 109          | 114 33         | 117      | 122 B      | 130 B    | 138 B            | 153.5<br>154.2  | 162      | 170      | 178              |
|                                       | rom Anno Heyrre 82 to 184.                                       |           | Begin-<br>ning A.<br>Hejiræ | 12 Dec          | 16 Sep     | 21 June<br>26 Mai | \$7375 S Jan | Table 7        | 3 Oct    | 9 Aug      | 14 May   | 16 Feb           | 21 Nov          | 31 May   | 5 Mar    |                  |
|                                       | rom Anno Heyrre 82 to                                            | Sunday 1  | A. D.                       | 200             | 71         |                   | 3737         | 7 12 5         | 7.15     | 750        | 758      | 266              | 773             | 789      | 797      |                  |
|                                       | rom An                                                           | Ž         | Anno                        | 88              | 96         | 104               | 119B.3       | 120.1<br>125 B | 128      | 133 B      | 141 B    | 149 B            | 157 B<br>165    | 173      | 181      |                  |

Third Chronological Table, continued.

IXth CENTURY

From Anno Cali yugam \$902 to 4001.

From Anno Hejiræ 185 to 238.

28 Aug Begin-ning A. Hejiræ 11 Aug 16 May 6 Nov 8 Apr 21 July 25 Apr ‰June 18 Feb 23 Nor 7 Mar 11 Jan 10 Dec 16 Oct 28 Jan ۲. From Anno 723 to \$22 Saca. 815 823 Saturday 846 854 869 890 890 Ö, 807 831 859 **8**98 867 874 \* 240 245 B 269 B 277 B 256 B Hejira 13 Anno 192253 ₹%° 935 948 201 200 208 285 210 Begin-ning A. Hejiræ 112 Aug 113 Apr 13 Sept 2 Feb 7 No. 23 Mai 7 Jan 26 Dec 9July 26 July 30 Apr 18June 4 Oct 10 Jan 30 Dec 16 Jaո 21 Oct ပ် 8025 865 \$000\$ A. D. 810 818 826 849 872 877 Friday 841 857 880 264 D 272 B 980 B Hejiræ 187B.6 287.2 255B.C Anno 186.2 195 203 243 202 235 259 211 227 251 1 Sept 6June 11 July 15 Apr 19 Feb Hejiræ 27 Nov 18 Sept 23 June 28 Mar 20 Dec 16 May 11 Mar 14 Dec Begin. ning A l Jan 6 Oct 'n 898 875 A. D. Thursday 883 888 891 896 84 ‡ 805 813 821 683 923 852 860 Hejiræ | Hejiræ 198 B 206 B 275 b 2 254.5 255.2  $\Lambda$ nno 883 B 190 25 65 65 214 230 85 63 85 85 246 505 278 Begin. 12 Nov 30 July 3 Sept 17 Aug 22 May SJane 25 Oct 4 May 7 Feb 24 Feb 29 Nov 13 Mar 20 Jan 20 Dec 17 Jan 4 Wednesday A. D. 803 808 816 824 833 870 S86 894 839 899 847 193 B 200 B 217 B 286 B ning A. Anno Hejiræ Hejiræ m 201 B 185 188 225 502 273 281 233 249 257 241 23 Sept 1 Aug 6 May 2 Apr 2 2 Aug Begin. 27 Oct s Feb 17 Nov 28June 25 Dec 19 Apr 27 May 10 Oct 15 July 29 Jan က \$335 842 A. D. 819 873  $\frac{x}{2}$ 811 814 8,7 850 853 998 268 Tuesday 908236 B Hejira 212 B 220B.3 2.28 13 ~ 231.1 Anno 204 196 544 360 263 **27**6 19.1 24 Apr 7 Sopi S Sopt logane, Hejiræ 17 Mm 1 Jan O Dec 7 Jan 39 Dec 20 July Begin. ning A. 3 Dec 12June 15 Oct 28 Feb 27 Jan 10 Jan <del>zii</del> ઝં \$368**{** 876  $\zeta_{8025}$ 817 861 825 **£13** 853 Ö. 830 833 837 Monday < 2 Mar 1256 B 6 217 13 Begin. ning A. Anno Hejiræ | Hejiræ 251.5 215 B 231 B 2.39 B 255.2 186.2 187B.6 \*210 223 194 202271 279  $\frac{218}{18}$ 22 Au-13 Nov 5 Aug 8 Dec 12 Sep 17 July 29 Mar 10 May 26 Dec 5 July 13 Ecb 5 Jan 30 Sept 31 Oct \_: **\**235**\** 857 857 ,0:8 811 805 **\$**04 812 820 848 856 864 871 A. D. 851 Sunday 250 B 2030 B 912 B 226 B  $\alpha$ Anno Hejiræ 220B.3 221.1 234 258 500 197 205 513 229 237 189

Third Chronological Table, continued.

| XXX                                   | eviii                                                            | ı <del></del>  |                             |         |             |                    |                 |         | <u> </u>   | <u>.</u> . | ęυ              | <u>ن</u> + |                  | 1-      |                 |                                        |
|---------------------------------------|------------------------------------------------------------------|----------------|-----------------------------|---------|-------------|--------------------|-----------------|---------|------------|------------|-----------------|------------|------------------|---------|-----------------|----------------------------------------|
|                                       | to. 410]                                                         | 7.             | Begin.<br>ning A.<br>Hejiræ | 2 Nov   | 12 May      | 14 Feb<br>19 Nov   | 24 Aug          | 29 May  | 4 Apr      | 3 Mar      | 7 Jan<br>28 Dec | 7 Dec      | 17 July          | 21 Apr  | 25 Jan          |                                        |
|                                       | n 4002<br>3 Saca.                                                | Saturday       | A. D.                       | 905     | 921         | 929<br>936         | 944             | 052     | 126        | 096        | <b>3005</b>     | 967        | 980              | 938     | 966             |                                        |
|                                       | From Anno Cali yugam 4002 to.4101.<br>From Anno 823 to 922 Saca. | Sat            | Anno<br>Hejiræ              | 293     | 60%         | 317<br>325         | 333             | 341     | 346 B      | 349        | 354B.7          | 357        |                  | 378 B   | 386 B           |                                        |
|                                       | 1 Anno C                                                         | 6.             | Begin.<br>ning A.<br>Hejiræ | 30 Sept | 5 July      | 9 Apr<br>13 Jan    | 18 <b>O</b> ct  | 23 July | 27 Apr     | 30 Jan     | 4 Nov           | 10 Sept    | 15June           | 20 May  | 33 Dec          | ^                                      |
| •                                     | Fron<br>Fron                                                     | Fiiday 6       | A. D.                       | 808     | 916         | 924                | 939             | 947     | 955        | 896        | 970             | 975        | 983              | 166     | ~8665<br>~      | 1                                      |
|                                       |                                                                  | í <del>ľ</del> | Anno<br>Rejiræ              | 296 B   | 304         | 320                | 328             | 336     | 344        | 352        | *860            | 365 B      |                  | 381 13  | 388.2<br>389.B6 |                                        |
| •                                     |                                                                  | 5.             | Begin.<br>ning A.<br>Hejiræ | 24 Nov  | 29 Aug      | 3June<br>8 Mar     | 11 Dec          | 15 Sept | 20June     | 25 Mar     | 7 Jan           | 2 Oct      | 7 July<br>13 May | 11 Арі  | 15 Feb          | 14 Jan                                 |
|                                       |                                                                  | Thursday       | A. D.                       | 903     | 911         | 916                | 934             | 942     | 950        | 958        | <b>3</b> 8655   | 973        | 980              | 989     | 994             | 266                                    |
| tinued.                               |                                                                  | Th             | Ânno<br>Hejiræ              | 291 B   | 299 B       | 307 B<br>315       | 323             | 331     | 339        | 347        | 354B.7          | 363        | 370 B            | 379     | 384 B           | 387                                    |
| able, con                             | JRY.                                                             | <b>→</b>       | Begin-<br>ning A.<br>Hejiræ | 16 Dec  | 22 Oct      | 20 Sept<br>27 July | 1 May           | 3 Feb   | 8 Nov      | 13 Aug     | 18 May          | 20 Feb     | 25 Nov<br>30 Aug | 4June   | 9 Маг           | 13 Dec                                 |
| gical T                               | Xth CENTURY                                                      | Wednesday      | A. D.                       | 106     | 906         | 909<br>914         | 922             | 930     | 937        | .945       | 953             |            | 908              | 984     | 303             | 999                                    |
| Third Chronological Table, continued. | X th                                                             | Wed            | Anno<br>Hejiræ              | 289     | 294 B       | 297<br>302 B       | 310 B           | 818 B   | 326 B      | 334        | 342             |            | 300              | 374     | 382             | *390                                   |
| Third (                               |                                                                  | 3.             | Begin-<br>ning A.<br>Hejiræ | 13 Nov  | 18 Aug      | 7 Aug<br>24June    | 23 May          | 29 Mar  | 1 Jan      | 6 Oct      | 11 July         | 15 Apr     | 19 Jan<br>24 Oct | 29 July | 3 May           | 5 Feb                                  |
|                                       |                                                                  | Tuesday 3.     | A. D                        | \$06    | 915         | 913<br>917         | 920             | 925     | <b>333</b> | 940        | 948             |            | 904              | 979     | 186             | 902                                    |
|                                       |                                                                  | £              | Anno<br>Ilejiræ             | 265     | 300         | 301<br>305 B       | 308             | 313 B   | 321B.3     | 329 B      | 337 B           | 345        | 361              | 369     | 377             | 385                                    |
|                                       |                                                                  |                | Begin-<br>ning A.<br>Hejiræ | 12 Oct  | iln£21      | 21 Apr<br>25 Feb   | 24 Jan          | 30 Nov  | 29 Oct     | 4 Sept     | 9June           | 14 Mar     | 21 Sept          | 26 June | 990 31 Mar      | 3 Jan<br>23 Dec                        |
|                                       |                                                                  | Monday 2.      | A. D.                       | 206     | 915         | 923<br>928         | 931             | 935     | 938        | 943        | 951             | 959        | 900              | 982     | 066             | ~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~ |
|                                       | 60 391.                                                          |                | Anno<br>IIcjiræ             | 295     | 303         | 311<br>316 B       | 319             | 324 B   | 327        | 332 B      | 340 B           | 348        | 356 LS           | 372     | 380             | 1 Dec 388.2 \$998 3 Jan                |
|                                       | ræ 259 f<br>to 1000                                              |                | Begin-<br>ning A.<br>Hejiræ | 5 Dec   | 9 Sept      | 14June<br>19 Mar   | 1 Jan<br>22 Dec | 26 Sept | 2 Aug      | 1 July     | 7 May           | 9 Feb      | 14 Nov<br>19 Aug | 24 May  | 26 Feb          | 1 Dec                                  |
|                                       | no Meji<br>D. 901                                                | Sunday 1.      | A. D.                       | 905     | 910         | 918<br>926         | \$33 <b>%</b>   | 941     | 946        | 949        | 954             | 296        | 969<br>977       | . 985   | 993             | 1000                                   |
|                                       | From Anno Hejiræ 259 to 391.<br>From A. D. 901 to 1600.          | Š              | Anno<br>Hejiræ              | 058     | <b>2</b> 98 | 306                | 391B.3          | 330     | 335 B      | 888        | 343 B           | . 351 B    | 359 B<br>1 367 B | 375     | 383             | 391                                    |

Third Chronological Table, continued.

| Parish Anno   Rejers 573 to 4304.   Parish   P | to 4201              | ei        | ,      | Begin.<br>ning A. |                                       | 16 Nov<br>21 Aug<br>26 May                   | 23 Feb<br>2 Jan<br>25 Dec<br>9 Oct<br>14 July<br>18 Apr                      |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------|-----------|--------|-------------------|---------------------------------------|----------------------------------------------|------------------------------------------------------------------------------|
| Monday 2.   Tuesday 3.   Wednesday 4.   Thursday 5.   Fridam Anno   Begin.   Hejira   Anno   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D | m 4102               | 022 Sac   | turgay |                   | <u>'</u>                              | 1                                            | 1063<br>1065<br>1070<br>1070<br>1078<br>1086                                 |
| Monday 2.   Tuesday 3.   Wednesday 4.   Thursday 5.   Fridam Anno   Begin.   Hejira   Anno   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D | ali yuga             | 923 to 1  | ñ      | Anno<br>Hejiræ    | 394<br>402<br>410<br>418              | 455<br>454<br>442<br>442                     | 455B.7<br>456.5<br>458 B<br>471 B<br>471 B<br>470 B                          |
| Monday 2.   Tuesday 3.   Wednesday 4.   Thursday 5.   Fridam Anno   Begin.   Hejira   Anno   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   A. D.   Hijira   Hijira   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D.   Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D. D. Hijira   A. D | Anno C               | Anno      |        |                   | 27 Sep<br>2 July<br>6 Apr<br>9 Jan    | 14 Oct<br>19 July<br>23 Apr                  | 31 Oct   6 Sep   5 Aug   11 June   10 May   16 Mar   19 Dec                  |
| Monday 2.   Tuesday 3.   Wedgesday 4.   Thursday 5.   Holing A.   Monday 2.   Tuesday 3.   Wedgesday 4.   Thursday 5.   Holing A.   Monday 2.   Tuesday 3.   Wedgesday 4.   Thursday 5.   Holing A.   Monday 2.   Holing A.  | From                 | Fron Fron |        | A. D.             | 1006<br>1014<br>1022<br>1032          | 1                                            |                                                                              |
| Monday 2.   Tuesday 3.   Wedgreeday 4.   Thursday 5.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |                      |           | '      | Anno              | 397 B<br>405<br>413<br>421.6          | 499<br>437<br>445<br>453                     | 466 B<br>466 B<br>471 B<br>477<br>482 B                                      |
| Begin.   Begin.   Tuesday 3.   Weinceday 4.   Thursday                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |                      | 2.        |        |                   | 20 Nov<br>25 Aug<br>30 May<br>4 Mar   | 7 Dec<br>11 Sep<br>16June<br>21 Mar          | 4 Jan<br>25 Dec.<br>29 Sep<br>4 July<br>8 Apr<br>12 Feb<br>11 Jan<br>31 Dec. |
| Monday 2.   Tuesday 3.   Wednesday 4.   The Begin                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |                      |           |        |                   | 1                                     |                                              |                                                                              |
| Monday 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |                      | Th        |        | Anno              | 392 B<br>400 B<br>408 B<br>416 B      | 432<br>432<br>448                            |                                                                              |
| Monday 2.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | ,<br>1RY.            |           |        |                   | 18 Oct<br>17 Sep<br>23 July<br>27 Apr | 5 Nov                                        |                                                                              |
| Monday       2.       Tuesday       3.         ning A.       Anno       Begin-       Regin-       Anno         ning A.       Hejiræ       A. D. Hejiræ       A. D. Hejiræ       Anno         1005       8 Oct       393       1002       10 Nov         1021       17 Apr       406       B 1015       20 May       44         1021       17 Apr       406       B 1015       20 May       44         B 1023       26 Nov       417       1026       22 Feb       42         B 1033       26 Nov       417       1026       22 Feb       42         B 1041       31 Aug       422 B       1036       22 Feb       42         B 1045       5June       430 B       1038       3 Oct       4         B 1064       13 Dec       446 B       1052       15 Jan       4         B 1064       13 Dec       446 B       1052       15 Jan       4         B 1064       13 Dec       446 B       1059       20 Oct       4         B 1088       27 Mar       470       1077       25 July       4         1088       27 Mar       470       1069       20 Apr                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | CENTU                | dnesday   |        |                   |                                       |                                              |                                                                              |
| Monday         2.         Tuesday         3.           ning A.         Anno         Begin-         Regin-           ning A.         Anno         Regin-           ning A.         Hejiræ         A. D. Hejiræ           1005         8 Oct         393         1002         10 Nov           1021         17 Apr         406         B 1015         21 June           1021         17 Apr         406         B 1015         20 May           1021         17 Apr         409         1018         20 May           1022         20 Jan         409         1018         20 May           1032         26 Nov         417         1026         22 Feb           1036         25 Oct         477         1026         22 Feb           1036         25 June         430 B         1036         29 Jan           1057         10 Mar         430 B         1052         15 Jan           1058         27 June         454 B         1052         15 Jan           1058         27 June         462         1069         20 Oct           1058         27 Mar         470         1077         25 July           25                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | XIth                 | We        |        | Anno<br>Hejiræ    | 395 B<br>398<br>403 B<br>411 B        | 419 B<br>427 B<br>435<br>443                 | 451<br>459<br>467<br>475<br>483<br>491                                       |
| Monday 2. Tuesday    Begin.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      | 3.        | Rain   |                   | 10 Nov<br>15 Aug<br>21 June<br>30 May | 20 Mar<br>22 Feb<br>9 Jan<br>29 Dec<br>3 Oct | 8 July 12 Ap; 15 Jan 20 Oct 25 July 1 Feb 6 Not                              |
| Monday 2.    Begin.   Hejira   Hejira   Hejira   Hejira   Hejira   Hejira   Hejira   Hojira |                      |           | -      | r. D.             | 1002<br>1010<br>1015<br>1018          | ~~                                           | . 1                                                                          |
| Monday 2.    Begin-   Ining A.     Ining A.     1005   8 Oct     1021   17 Apr     1029   20 Jan     1036   25 Oct     1049   25 Oct     1049   25 Uct     1057   10 Mar     1064   13 Dec     1072   17 Sep     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June     1080   22 June                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |                      | T.        |        | Anno<br>Hejiræ    | 393<br>401<br>406 B<br>409            | 417<br>417<br>421. 6<br>422.8.3<br>430 B     | 438<br>446<br>454<br>462<br>470<br>470<br>478<br>494                         |
| M Cal III a a a a a a a a a a a a a a a a a                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |                      | 64        | Begin. |                   | 8 Oct<br>13 July<br>17 Apr<br>20 Jan  |                                              | 10 Mar<br>13 Dec<br>17 Sep<br>22 June<br>27 Mar<br>11 Jan<br>31 Dec          |
| From Anno Hejiræ 392 to 494.           From A. D. 1001 to 1100.           Anno Hejiræ         Begin-Ining A. D. Hejiræ         Anno Hejiræ           399         1008         5 Sep 396           407         1016         10 June 404           415         1024         15 Mar 412           423         1031         19 Dec 425 B           431         1039         23 Sep 420           432         1047         28 June 423 B           439         1047         28 June 423 B           444 B         1052         3 May 441 B           447         1055         2 Apr 445 B           452 B         1060         6 Feb 457 B           460 B         1067         11 Nov 465           468 B         1075         16 Aug 473           476 B         1083         21 May 488.5           484         1091         23 Feb 488.5           484         1091         23 Feb 488.5                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |                      | 1         |        | A. D.             | 1005<br>1013<br>1021<br>1029          | 1036<br>1041<br>1049                         | 1057<br>1064<br>1072<br>1080<br>1088<br>\$1095                               |
| From Aqno Hejiræ 392 to 1100.           Sunday 1.           Anno         IBegin-Ning A. D. Hejiræ 407           407         1008         5 Sep 407           415         1024         15 Mar 415           423         1031         19 Dec 58 Janc 58                                                                                                                                                                                                                                                | 494.                 | M         |        | Anno              | 396<br>404<br>412<br>* 420            |                                              | 1                                                                            |
| From Anno Hejir<br>Sunday 1.  Sunday 1.  Anno Hejiræ A. D. 399 407 1016 415 1024 423 1031 436 1047 444 B 1052 447 1055 450 B 1065 460 B 1067 468 B 1075 468 B 1075 476 B 1083 476 B 1083 476 B 1083                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | æ 392 to<br>to 1100. |           | Begin. |                   | 5 Sep<br>10 June<br>15 Mar<br>19 Dec  | 29 July<br>28 June<br>3 May                  | 2 Apr<br>6 Feb<br>11 Nov<br>16 Aug<br>21 May<br>23 Feb<br>28 Nov             |
| From An Su Su Su Su Su Su Su Su Su Su Su Su Su                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               | no Hejir<br>D. 1001  | nday 1.   |        | A. D.             |                                       | 10147                                        | 1055<br>1067<br>1067<br>1075<br>1083<br>1091                                 |
|                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | From An              | nç.       |        |                   | 399<br>407<br>415<br>423              | 436 B<br>439<br>444 B                        | 417<br>452 B<br>460 B<br>468 B<br>476 B<br>484<br>492                        |

Third Chronological Table, continued,

XIIth CENTURY.

From Anno Hejiræ 495 to 597. From A. D. 1101 to 1200.

| From /         | Anno He<br>V. D. 11 | From A. D. 1101 to 1200.    | to 597.<br>30. |               |                             |                 |              |                            | XIIth          | XIIth CENTURY. | 'URY.                       |              |                 | •                           |              | Fron      | From Anno Cali yugam 4202 to | Cali yuga | 1m 4205        | From Anno Cali yugam 4202 to 4301. |
|----------------|---------------------|-----------------------------|----------------|---------------|-----------------------------|-----------------|--------------|----------------------------|----------------|----------------|-----------------------------|--------------|-----------------|-----------------------------|--------------|-----------|------------------------------|-----------|----------------|------------------------------------|
|                | Sunday 1.           | 1.                          |                | Monday        | ાં                          |                 | Tuesday      | 3.                         | M ==           | Wednesday      | y 4.                        | T.           | Thursday        | 5.                          | F            | Friday 6. |                              | S S       | Saturday       | .ca.                               |
| Anno<br>Hejiræ | A. D.               | Begin-<br>ning A.<br>Hejiræ | Anno<br>Hejiræ | <br> A. D.    | Begin-<br>ning A.<br>Hejiræ | Anno<br>Hejiræ  | A. D.        | Begin-<br>ning A<br>Rejiræ | Anno<br>Hejiræ | A. D.          | Begin-<br>ning A.<br>Hejiræ | Anno         | A. D.           | Begin.<br>ning A.<br>Hejiræ | Anno         | A. D.     | Begin.  <br>ning A.          | Anno      | ,   4          | Begine<br>ning A.                  |
| 500            | 1106                | <del></del>                 |                | 1103          |                             |                 | 1108         | 11 Aus                     | 496 B          | 1102           | 15 Oct                      | 501 13       | 1107            | ag Aug                      | 498 B        |           | 23 Sep                       | 495       | i   5          | auchus<br>26 Oct                   |
| 508            | 1114                | 7 June                      |                | 1111          |                             |                 |              | 16May                      |                | 1105           | 13 Sep                      | 509 B        | 11115           | 27 May                      | \$06 B       | 1112      | 28June                       | 503       |                | 31 July                            |
| 524            | 11129               |                             | 521            | 11127         | 1 4 Apr<br>17 Jan           | 515 B<br>  518  | 1121         | 22 Mar<br>19 Feb           | 504 B<br>507   | 1110           | 20July<br>18June            | 517 B<br>525 | 1123            | 1 Mar                       | 514<br>522.6 | 1120      | 2 Apr<br>6 Jan               | 511       |                | 5 May                              |
|                |                     |                             |                |               |                             |                 |              | - 1                        |                |                |                             | j            |                 |                             | 52315.3      | ~         | 25 Dec                       | 6+0       | 22.1           | -/ Feb                             |
| 532            | 1137                | 19 Sep                      | 526 B          | 1131          | 23 Nov                      | 523B.3          | <b>31128</b> | 6 Jan<br>25 Dec            | 512 B          | 1118           | 24 Apr                      | 533          | 1138            | 8 Sep                       | 530          | 1135      | 11 Oct                       | 527       | 1132           | 12 Nor                             |
| 540            | 1145                | 24June                      | 529            | 1134          | 22 Oct                      | 531 B           | 1136         | 29 Sep                     | 520 B          | 1126           | 27 Jan                      | 541          | 1146            | }<br> 3June                 | 538          |           | ¥2                           | بر<br>عر  |                | 1                                  |
| 545 B          | 1150                | 30 Apr                      | 534 B          | 1189          | 28 A ug                     |                 |              | 4 July                     | 528 B          |                | 1 Nov                       | 5-19         | 1154            | 18 Mar                      | 546          |           | 20 Apr                       | 5.13      |                | 1/ Aug                             |
| orc            |                     | Mark Co                     |                | 2411          | ámc /z                      | 547 15          | 1152         | 8 Apr                      | 536 B          | 11/11          | 6 Aug                       | 557          | 1161            | 21 Dec                      | 554          |           | 23 Jan                       | 551       |                | 25 Feb                             |
| 553 B          | 1158                | 2 Feb                       | 542 B          | 11147         | 2June                       | 555.3<br>556B.7 | \$1160       | 12 Jan<br>31 Dec           | 544            | 1149           | 11 May                      | 565          | 1169            | 25 Sep                      | 562          | 1166      | 28 Oct                       | 555,3     | \$11605 12 Jan | 12 Jan                             |
| 561 B          | 1165                | 7 Nor                       | 550 B          | 1155          | 7 Mar                       | 563             | 1167         | 17 Oct                     | 552            | 1157           | 13 Feb                      | 573          | 1177            | 30June                      | 570          | 1171      | 9. A 110                     |           | 1163           | 31 Dec                             |
| 569 B<br>577 B | 1173<br>1181        | 12 Aug<br>17 May            | 558 B<br>566 B | 1161<br>1170  | 10 Dec<br>14 Sep            | 571<br>579      | 1175         | 22 July<br>26 Apr          | 560<br>568     | 1164           | 18 Nov<br>23 Ang            | 581<br>586 B | 1185            | 4 Apr                       | 575 B        |           | S.June                       | 564 B     |                | 5 Oct                              |
|                |                     |                             |                |               |                             |                 | - 1          | -                          | <u> </u>       | ,              |                             |              |                 | o I co                      | 676          |           | / May                        | /00       | 1171           | 4 Sep                              |
| 585            |                     | 19 Feb                      | 574            | 1178          | 19June                      | 587             | 1191         | 29June                     | 929            | 1180           | 28 May                      | 589.5        | \$1193 <b>}</b> | 7 Jan                       | 583 B        | 1187      | 13 Mar                       | 572 B     | 1176           | 10 July                            |
| 200            | 9611                | 24 Nov                      | 582            | 1186          | 24 May<br>7 Jan             | 595             | 1197         | 3 Nov                      | 58.4           | 1188           | 2 Mar                       | 504 B        | 1197            | 13 Nov                      | 591 B        | 1194 1    | 16 Dec                       | 580 B     | 1184           | 14 Apr                             |
|                |                     |                             | 590.2          | Z611 <b>5</b> | 590.2 \$1193 27 Dec         |                 |              |                            | 593            | 1195           | 6 Dec                       | 597          | 1200            | 12 Oct                      |              |           |                              | 588 B     | 1192           | 18 Jan                             |
| -<br> -        |                     |                             |                |               | _                           |                 |              |                            |                | -  <u>.</u>    | =                           | - !<br>      |                 | ==                          |              | -         | -                            | 596 Bl    | 1199 6         | 23 Oct                             |

Third Chronological Table, continued.

|                                                                    |           |                                    |                   |                      |                        |                   |         |         |        | •              |                                        |        | •                      |             |                        | 3                |
|--------------------------------------------------------------------|-----------|------------------------------------|-------------------|----------------------|------------------------|-------------------|---------|---------|--------|----------------|----------------------------------------|--------|------------------------|-------------|------------------------|------------------|
| From Anno Cali yugam 4302 to 4401.<br>From Anno 1123 to 1222 Suca. | 7.        | Begin.<br>ning A.<br>Hejiræ        | 28 July           | 2 May<br>4 Feb       | 9 Nov                  | 14 Aug            | 19 May  | 21 Feb  | 26 Nov | 2 Oct          | 31 Aug                                 | 7 July | 11 Apr                 | 14 Jan      | 19 Oct                 |                  |
| ım 4309<br>222 Sac                                                 | Saturday  | A. D.                              | 1207              | 1215                 | 1230                   | 1238              | 1946    | 1254    | 1261   | 1266           | 1269                                   | 1274   | 1282                   | 1290        | 1297                   |                  |
| Ali yuga<br>123 to 1                                               | Š         | Anno<br>Hejiræ                     | \$00              | 612<br>620           | 628                    | 686               | 644     | 652     | 099    | 665 B          | 899                                    | 673 B  | 681 B                  | 689 B       | G 269                  |                  |
| Krom Anno Celi yugam 4302 te<br>From Anno I123 to 1222 Secs.       | •         | Begin.<br>ning A.<br>Hejiræ        | 20 Sep            | 25 June<br>30 Mar    | 2 Jan<br>22 Dec        | 7 Oct             | 12 July | 16 Apr  | 19 Jan | 24 Oct         | 29 July                                | 4June  | 3 May                  | 9 Mar       | 6 Feb                  | 12 Dec<br>16 Sep |
| Fron<br>From                                                       | Friday 6. | A. D.                              | 1902              | 1210<br>1218         | <b>}</b> 1556 <b>}</b> | 1233              | -       | 1249    | 1257   | 1264           | 1272                                   | 1977   | 1280                   | 1285        | 1988                   | 1292<br>1300     |
|                                                                    | I         | Anno<br>Rejiræ                     | 599 B             | 607 B<br>615         | 623.6<br>624B.3        | 631               | 639     | 647     | 655    | 663            | 671                                    | 676 B  | 679                    | g 189       | 289                    | 692 B<br>700 B   |
|                                                                    | ž.        | Begin.<br>ning A.<br>Hejiræ        | 18 Aug            | 23 May<br>25 Feb     | 30 Nov                 | 4 Sep             | 9June   | 14 Mar  | 18 Dec | 22 Sep         | 27 June                                | 1 Apr  | 4 Jan<br>24 Dec        | 10 Nov      | 9 Oct                  | -                |
|                                                                    | Thursday  | A. D.                              | 1205              | 1213<br>1221         | 1228                   | 1236              | 1244    | 1252    | 1259   | 1267           | 1275                                   | 1983   | <b>}</b> 1291 <b>}</b> | 1295        | 1298                   |                  |
|                                                                    | dT.       | Anno<br>Hejiræ                     | 602 B             | 610 B<br>618 B       | 626 B                  | 634               | 642     | 650     | 658    | 999            | 674                                    | 683    | 690. 5                 | 695 B       | 869                    |                  |
| RY.                                                                | 4.        | Begin.<br>ning A.<br>Hojiræ        | 10 Sep            | 16 July<br>15 June   | 20 Apr                 | 24 Jan            | 29 Oct  | 3 Aug   | 8 May  | 10 Feb         | 15 Nov                                 | 90 Aug | 25 May                 | 27 Feb      | 2 Dec                  |                  |
| CENTU                                                              | Wedeesday | Λ. D.                              | 1203              | 1208                 | 1216                   | 1221              |         | 1239    | 1247   | 1255           | 1262                                   | 1270   | 1278                   | 1286        | 1293                   |                  |
| XIII <sup>de</sup> CENTURY.                                        | We        | Anno<br>Hejiræ                     | ,<br>\$600        | 605 B                | 613 B                  | 621 B             |         | 637 B   | 645    | 053            | 199                                    | 699    | 677                    | 685         | £69                    |                  |
|                                                                    | 33        | Begin.<br>ning A.<br>Hejiræ        | ğu. <b>8</b> . Ng | 13 May<br>19 Mar     | 15 Feb                 | 2 Jan<br>22 Dec   | 20 Nov  | 56 Sep  | 1 July | 5 Apr          | 29 Dec                                 | 13 Oct | 18 July                | 22 Apr      | 25 Jan                 | 30 Oct           |
|                                                                    | Tuesday 3 | A. D.                              | 1206              | 1214<br>1219         | 1222                   | 1226              | 1929    | 1534    | 1242   | 1550           | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ | 1265   | 1273                   | 1281        | 1989                   | 1296             |
|                                                                    | Tr        | Anno<br>Hejiræ                     | 8,09              | 611<br>61 <b>6</b> B | 619                    | 623.6             | 269     | 632 B   | 640 B  | 3 Mar   6-18 B | 6 Dec   656B.3                         | 664    | 673                    | 630         | 889                    | 969              |
|                                                                    |           | Begin. Ining A. Anno Hejira Hejira | 1 Oct             | 6 July 10 Apr        | 1225 13 Jan            | 1232 18 Oct 623.6 | 54 Aug  | 23 July | 29 May | 3 Mar          | 6 Dec                                  | 10 Sep | 15June                 | 1284 20 Mar | 4 Jan<br>24 Dec        | 1200 28 S.p.     |
| ,                                                                  | Monday 2, | A D.                               | 1201              | 1209<br>1217         | 1225                   | 1233              | 1937    | 1240    | 12.45  | 1253           | 659 B 1260                             | 1268   | 1276                   | 1281        | <b>}</b> 1621 <b>}</b> | 1300             |
| .269                                                               | ğ         | Anno<br>Hejiræ                     | 598               | 606<br><b>614</b>    | 623                    | *<br>630          | 635 B   | 889     | 643 B  | C51 B          | 659 B                                  | 667 B  | 67.5                   | 683         | <del>K</del>           | 669              |
| s 598 to<br>to 1300.                                               | ==        |                                    | 29 Aug            | 3.June<br>S Mar      | 12 Dec                 | 16 Sep            | 21June  | 26 Apr  | 26 Mar | 30 Jan         | 8 Jan                                  | 4 Nov  | 9 Aug                  | 1279 14 May | 1287 16 Feb            | 1294 21 Nov 699  |
| o Hejira<br>D. 1201                                                | Sunday 1. | Begin-<br>ning A.<br>A. D. Hejiræ  | 1204              | 1212<br>1220         | 1927                   | 1235              | 1243    | 1248    | 1251   | 1256 30 Jan    | <b>\$1258</b>                          | 1263   | 1271                   | 1279        |                        |                  |
| From Anno Hejiræ 598 to 697.<br>From A. D. 1201 to 1300.           | Sul       | Anno<br>Hejiræ                     | 109               | 609                  | 625                    | 683               | 641     | 646 B   | 649    | 654 B          | 656B.3 21258 8 Jan                     | 662 B  | 670 B 1271             | 678 B       | g 989                  | 694              |
| ĒĀ                                                                 |           | 1 124                              |                   |                      |                        |                   |         |         |        |                |                                        |        |                        |             |                        |                  |

From Anno Cali yugam 4402 to 4501. From Anno 1223 to 1322 Saca.

Third Chronological Table, continued.

XIV<sup>th</sup> CENTURY.

| 08.                          | , 1400.                  |  |
|------------------------------|--------------------------|--|
| From Anno Hejira 701 to 803. | From A. D. 1301 to 1400. |  |
| Anno                         | A. D.                    |  |
| From                         | From                     |  |
|                              |                          |  |

| ٠          | •                                 | •                                                         |                                        |                                                            |                                           |
|------------|-----------------------------------|-----------------------------------------------------------|----------------------------------------|------------------------------------------------------------|-------------------------------------------|
| 7.         | Begin.<br>ning A.<br>Hejiræ       | 1305, 24 July<br>1313 28 Apr<br>1321 31 Jan<br>1328 5 Nov | 10 Aug<br>15 May<br>18 Feb<br>23 Nov   | 28 Sept 18 Aug 3 July 2 June                               | 1380 7 Apr<br>1387 11 Jan<br>1395 16 Oct  |
| Saturday 7 | A. D.                             | 1305<br>1313<br>1321<br>1 <b>\$</b> 28                    | 1336<br>1344<br>1352<br>1359           | 1364<br>1367<br>1372<br>1375                               |                                           |
| Sa         | Anno<br>Hejiræ                    | 705<br>713<br>721<br>729                                  | 737<br>745<br>753<br>761               | 765 B<br>769<br>77.4 B                                     | 782 B<br>790B.7<br>791.5<br>798 B         |
|            | Begin-<br>ning A.<br>Hejiræ       | 21 June<br>26 Mar<br>10 Jan<br>30 Dec<br>4 Oct            | 9 July<br>13 Apr<br>16 Jan<br>21 Oct   | 26 July<br>3 Apr<br>6 Mar<br>2 Feb                         | 9 Dec<br>13 Sept                          |
| Friday 6.  | A. D.                             | 1308<br>1316<br>1323<br>1331                              | 1339<br>1351<br>1355<br>1362           | 1370<br>1378<br>1383<br>1386                               | 1390                                      |
|            | Anno<br>Hejiræ                    | 708 B<br>716 B<br>723.2<br>724.6<br>732                   | 740<br>748<br>756<br>764               | * 779<br>* 780<br>785 B                                    | 793 B<br>801 B                            |
| 5.         | Begin-<br>ning A.<br>Hejiræ       | 15 Aug<br>20 May<br>22 Fcb<br>27 Nov                      | 1 Sept<br>6 June<br>11 Mar<br>14 Dec   | 18 Sept<br>23June<br>28 Mar<br>11 Jan<br>31 Dec            | 6 Nov<br>5 Oct                            |
| Thursday   | A. D.                             | 1303<br>1311<br>1319<br>1326                              | 1334<br>1842<br>1850<br>1357           | 1365<br>1373<br>1381<br>}1387                              | 1393                                      |
| E          | Anno<br>Hejiræ                    | 703 B<br>711 B<br>719 B<br>727 B                          | 735<br>743<br>751<br>759               | 767<br>775<br>783<br>790B.7<br>791.5                       | 796 B<br>799                              |
| 4.         | Begin-<br>ning A.<br>Hejiræ       | 6 Sept<br>13 July<br>11 June<br>17 Apr                    | 16 Mar<br>20 Jan<br>25 Oct<br>30 July  | 4 May<br>6 Feb<br>11 Nov<br>16 Aug                         | 21 May<br>24 Feb<br>29 Nov<br>3 Sep       |
| Wednesday  | 4. D.                             | 1306<br>1306<br>1309<br>1314                              | 1317<br>1322<br>1329<br>1337           | 1345<br>1353<br>1360<br>1368                               | 1376<br>1384<br>1391<br>1399              |
| )<br>M     | Anno<br>Hejiræ                    | 701<br>706 B<br>709<br>714 B                              | 717<br>722 B<br>730 B<br>738 B         | 746 B<br>754<br>762<br>770                                 | 778<br>786<br>794<br>802                  |
| 65         | Begin.<br>ning A.<br>Hejiræ       | 4 Aug<br>9 May<br>12 Feb<br>18 Dec                        | 17 Nov<br>22 Sept<br>27 June<br>1 Apr  | 5 Jan<br>25 Dec<br>10 Oct<br>15 July<br>19 Apr             | 22 Jan<br>27 Oct                          |
| Tuesday    | A. D.                             | 1304<br>1312<br>1320<br>1324                              | 1332<br>1332<br>1340<br>1348           | \$1356<br>1363<br>1371<br>1379                             | 1387                                      |
| L          | Anno<br>Hejiræ                    | 704<br>712<br>*<br>720<br>725 B                           | 728<br>733 B<br>741 B<br>749 B         | 757B.3<br>758.1<br>765<br>773                              | 797                                       |
| લં         | Begin-<br>ning A.<br>A. D. Hejiræ | 3 July<br>7 Apr<br>10 Jan<br>30 Dec<br>15 Oct             | 21 Aug<br>20 July<br>25 May<br>24 Apr  | 28 Feb<br>3 Dec<br>7 Sept<br>12June                        | 1382 17 Mar<br>1389 20 Dec<br>1397 24 Sep |
| Monday     | Ą. D.                             | 1307<br>1315<br>\$1323<br>1330                            | 1335<br>1338<br>1343<br>1346           | 1351<br>1358<br>1366<br>1374                               | 1382<br>1389<br>1397                      |
|            | Anno                              | 707<br>715<br>723.2<br>724.6<br>731                       | 736 B<br>739<br>744 B<br>747           | 752 B<br>769 B<br>768 B                                    | 784<br>792<br>500                         |
| Sunday 1.  | Begin-<br>ning A.<br>A. D. Hejiræ | 26 Aug<br>31 May<br>5 Mar<br>8 Dec                        | 12 Sept<br>17 June<br>22 Mar<br>26 Jan | 356   5 Jan   1361   31 Qct   1369   5 Aug   1377   10 May | 1392 17 Nov<br>1400 22 Aug                |
| Sunday 1.  |                                   | 1302<br>1310<br>1318<br>1325                              | 1333<br>1341<br>1349<br>1354           |                                                            | i                                         |
| r roin     | Anno<br>Hejiræ                    | 702<br>710<br>718<br>726                                  | 734<br>742<br>*750<br>755 B            | 757B.3<br>758.1<br>763 B<br>771 B<br>779 B                 | 787 B<br>795<br>803                       |

Third Chronological Table, continued.

From Anno Hejiræ 804 to 906. From A. D. 1401 to 1500.

XV<sup>th</sup> CENTURY.

From Anno Cali yugam 4502 to 4601, From Anno 1323 to 1422 Saca.

| 7.                                              |                                   | 21 July<br>25 Apr<br>28 Jan<br>2 Nov           | 7 Aug<br>12 May<br>14 Feb<br>19 Nov                        | 24 Aug<br>30June<br>29 May<br>4 Apr      | 7 Jan<br>28 Dec<br>12 Oct              |
|-------------------------------------------------|-----------------------------------|------------------------------------------------|------------------------------------------------------------|------------------------------------------|----------------------------------------|
| 1422 Sac<br>Saturday                            | A. D.                             | 1403<br>1411<br>1419<br>1426                   | 1434<br>1442<br>1450<br>1457                               | 1465<br>1470<br>1473<br>1473             | \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\ |
| 1323 to 1                                       | Anno<br>Hejiræ                    | 806 B<br>814<br>822<br>830                     | 838<br>846<br>854<br>862                                   | *<br>870<br>875 B<br>878<br>878<br>883 B | 891B.7<br>892. 5<br>899 B              |
| From Anno 1323 to 1422 Saca. ay 6.   Saturday 7 | Begin.<br>ning A.<br>Hejiræ       | 18 June<br>23 Mar<br>6 Jan<br>26 Dec<br>30 Sep | 5 July<br>9 Apr<br>12 Jan<br>17 Oct                        | 22 July<br>26 Apr<br>2 Mar<br>30 Jan     | 5 Dec<br>4 Nov<br>9 Sep                |
| Fro<br>Friday                                   | A. D.                             | 1406<br>1414<br>\$1421<br>1429                 | 1437<br>1415<br>1453<br>1460                               | 1468<br>1476<br>1481<br>1481             | 1488<br>1491<br>1496                   |
|                                                 | Anno<br>Hejiræ                    | 809 B<br>817 B<br>824. 2<br>825. 6             | 841<br>849<br>857<br>865                                   | 873<br>881<br>886 B                      | 894 B<br>897<br>902 B                  |
| 5.                                              | Begin-<br>ning A.<br>Hejiræ       | 11 Aug<br>10 July<br>16 May<br>18 Feb          | 23 Nov<br>28 Aug<br>2June<br>7 Mar                         | 11 Dcc<br>15 Sep<br>20 June<br>25 May    | 7 Jan<br>23 Dec<br>2 Oct<br>8 Aug      |
| Thursday                                        | A. D.                             | 1401<br>1404<br>1409<br>1417                   | 1424<br>1432<br>1440<br>1448                               | 1455<br>1463<br>1471<br>1479             | \$1486\$<br>1494<br>1499               |
| I                                               | Anno<br>Hejiræ                    | 804 B<br>807<br>812 B<br>820 B                 | 828 B<br>836 B<br>844<br>852                               | 868<br>876 .<br>881                      | 891B.7<br>892.5<br>* 900<br>905 B      |
| -;                                              | Begin-<br>luing A.<br>Hejiræ      | 8June<br>13 Apr<br>13 Mar<br>17 Jan            | 22 Oct<br>27 July<br>1 May<br>3 Feb                        | 8 Nov<br>13 Aug<br>18 May<br>20 Feb      | 25 Nev<br>30 Aug                       |
| Wednesday                                       | A. D.                             | 1407<br>1412<br>1415<br>1420                   | 1427<br>1435<br>1443<br>1451                               | 1458<br>1466<br>1474<br>1.182            | 1489                                   |
| Wed                                             | Anno                              | 815 B<br>818<br>823 B                          | 831 B<br>839 B<br>847 B<br>855                             | 863<br>871<br>879<br>887                 | 895<br>903                             |
| 3.                                              | Begin.<br>ning A<br>Hejiræ        | 1 Aug<br>6 May<br>8 Feb<br>15 Dec              | 13 Nov<br>19 Sep<br>18 Aug<br>24June                       | 29 Mar<br>1 Jan<br>22 Dec<br>6 Oct       | 15 Apr<br>18 Jan<br>23 Oct<br>25 July  |
| Tuesday                                         | A. D.                             | 1402<br>1410<br>1418<br>1422                   | 1425<br>1430<br>1433<br>1438                               | \$1454<br>1161<br>1161<br>1469           | 1477<br>1485<br>1492<br>1500           |
| É-I                                             | Anno<br>Hejiræ                    | 805<br>813<br>821<br>826 B                     | 829<br>834 B<br>837<br>842 B                               | 850 B<br>858B.3<br>859.1<br>806 B<br>874 | 890<br>890<br>898<br>906               |
| 6                                               | Begin.<br>ning A.<br>A. D. Hejiræ | 29June<br>3 Apr<br>6 Jan<br>26 Dec<br>11 Oct   | 1436 16 July<br>11411 22 May<br>1444 10 Apr<br>1449 21 Feb | 29 Nov<br>3 Sep<br>8 June<br>13 Mai      | 17 Dec<br>21 Sep                       |
| Monday                                          | A. D.                             | 1405<br>1413<br>\$1421<br>1428                 |                                                            | 1456<br>1472<br>1480                     | 1495                                   |
| M                                               | Anno<br>Hejiræ                    | \$08<br>816<br>824.2<br>\$25.6<br>832          | * 845 B 848 853 B                                          | 861 B<br>869 B<br>877 B<br>885           | 901                                    |
|                                                 | Begin-<br>ning A<br>A. D. Hejiræ  | 27 May<br>1 Mar<br>5 Dec<br>9 Sep              | 1439 14Junc<br>1447 19 Mar<br>1452 23 Jun<br>1454 22 Dec   | 28 Oct<br>26 Sept<br>2 Aug<br>7 May      | 9 Feb<br>14 Nov<br>19 Mey              |
| Sunday 1.                                       | A. D.                             | 1408<br>1416<br>1423<br>1431                   | 1439<br>1447<br>1452<br>1454                               | 1469<br>1467<br>1467<br>1475             | 1403<br>1400<br>1108                   |
| Š                                               | Anno<br>Hejiræ                    | 811<br>819<br>827<br>835                       | 813<br>851<br>858 B<br>859.1                               | 864 B<br>867<br>872 B<br>880 B           | 888 B                                  |

Third Chronological Table, continued.

From Anno Helira 907 to 1009. From Anno Domini 1501 to 1660.

XVIC CENTURY.

From Anno Cali yugam 4602 to 4701. : From Anno 1423 to 1522 Saca.

|        | Sunday 1. | Sunday 1.   Mc                    | 007 01 1 | Monday 2.     | si                         | T                                       | Tuesday                | 35                         | We             | Wednesday 4. | 4.                                    | Th             | Thursday | 5.                         | હ                                             | Friday 6.      |                             | Sat            | Saturday     | 7.                          |
|--------|-----------|-----------------------------------|----------|---------------|----------------------------|-----------------------------------------|------------------------|----------------------------|----------------|--------------|---------------------------------------|----------------|----------|----------------------------|-----------------------------------------------|----------------|-----------------------------|----------------|--------------|-----------------------------|
| Anno   | <b></b>   | Begin.<br>ning A.<br>A. D. Hejiræ | Anno     | A.D.          |                            | Begin-<br>ning A. Anno<br>Hejiræ Heyiræ | A. D.                  | Begin-<br>ning A<br>Hejira | Anno<br>Hejiræ | A. D.        | Begin-<br>ning A.<br>Hejiræ           | Anno<br>Hejiræ | A. D.    | Begin-<br>ning A<br>Hejiræ | Anno<br>Hejiræ                                | A. D.          | Begin-<br>ning A.<br>Hejiræ | Anno<br>Hejiræ | A. D.        | Begin.<br>ning A.<br>Hejiræ |
| 919    | 1506      | 24 May<br>26 Feb                  |          | <u> </u>      | 1503 26June<br>1511 31 Mar | 914                                     | 1508                   | 2 May<br>5 Feb             | 911<br>916 B   | 1505<br>1510 | 4June<br>10 Apr                       | 908<br>913 B   | 1502     | 7 July                     | 910 B                                         | 1504           | 14June<br>19 Mar            | 907 B<br>915   | 1501<br>1509 | 17 July<br>21 Apr           |
| 826    | 1521      |                                   |          | <b>\</b> 1519 | (1519) 3 Jan               | *930                                    | 1523                   | 10 Nov                     | 919            | 1513         | 9 Мал                                 | 921 B          | 1515     | 15 Feb                     | 926B.6                                        | {1519 <b>}</b> | 3 Jan<br>23 Dec             | 923            | 1517         | 24 Jan                      |
| 936    | 1529      | 5 Sep                             |          | 1526          | 8 Oct                      | 935 B                                   | 1528                   | 15 Sep                     | 924 B          | 1518         | 13 Jan                                | 929 B          | 1522     | 20 Nov                     | 934                                           | 1527           | 27 Sept                     | 931            | 1524         | 29 Oct                      |
| 944    | 1537      | 10 June                           | 941      |               |                            | <u> </u>                                |                        | 15 Aup                     |                | <b>"</b>     | 12 Dec                                | 937 B          |          | 25 Aug                     | 942                                           | 1535           | 2.July                      | 939            | 1532         | 3 Aug                       |
| 959    | 1545      | 15 Mar                            |          | 1539          | 19 May                     | 943 B                                   | 1536                   | 20June                     | 932 B          | 1525         | 18 Oct                                | 945            | 1538     | 30 May                     | 000                                           | 1543           | 6 Apr                       | 1 242          | 1540         | 8 May                       |
| \$ 960 | 1552      | 1552 18 Dec                       | 949      | 1542          | 17 Apr                     | 951 B                                   | 1544                   | 25 Mar                     | 940 B          | 1533         | 2 July                                | 953            | 1546     | 4 Mar                      | 959B.3                                        | <b>{1991</b>   | 29 Dec                      | 955            | 1548         | 11 Feb                      |
| 965 B  | 1557      | 24 Oct                            | 954 B    | 1547          | 21 Feb                     | 958.6<br>959B.3                         | <b>}</b> 1551 <b>{</b> | 9 Jan<br>29 Dec            | 948 B          | 1541         | 27 Apr                                | 1961           | 1553     | 17 Dec                     | 996                                           | 1558           | 14 Oct                      | 963            | 1555         | 16 Nov                      |
| 896    | 1560      | 1560 22 Sep                       | 957      | 1550          | 1550 20June                | 967 B                                   | 1                      | 3 Oct                      | 956 B          | 1549         | 30June                                | 696            |          | 11 Sept                    | <u>'                                     </u> |                | 19 July                     | 971            | 1563         | 21 Aug                      |
| 973 B  | 1565      | 29 July                           | 962 B    | 1554          | 26 Nov                     | 975                                     | 1567                   | 8 July                     | 964            | 1556         | 4 Nov                                 | 226            | 1569     | 16June                     | 286                                           | 1574           | 3 Apr                       | 976 B          | 1268         | 26June                      |
| 981 B  | 1573      | 3 May                             | 970 B    |               | 1562 31 Aug                | 983                                     | 1575                   | 12 Apr                     | 972            | 1564         | 9 Aug                                 | 985            | 1577     | 21 Mar                     | 066                                           | 1582           | 26 Jan                      | 626            | 1571         | 26 May                      |
| 989 B  | 1581      | 5 Feb                             | 978 B    | 1570          | 5June                      |                                         |                        |                            | 086            |              | 14 May                                |                |          |                            |                                               |                |                             | 984 B          | 1576         | 31 Mar                      |
|        |           | =                                 | 866 B    | 1578          | 10 Mar                     |                                         |                        | -                          | 866            | 1580         | 17 Feb                                | _              |          | _                          | _                                             | -              | _                           | 1 987          | 1579         | 28 Feb                      |
|        |           |                                   |          |               |                            |                                         | GREGO                  | RIAN                       | REFOR          | MATI         | SCORIAN REFORMATION 4TH OCTOBER 1582. | Остовы         | п 1582   |                            |                                               |                |                             |                |              |                             |
|        |           |                                   |          |               |                            |                                         |                        |                            |                |              |                                       |                |          |                            |                                               |                |                             |                |              |                             |

| 4.14 Ja<br>9.19<br>Oct.                                                                       | 14.24<br>July            |                      |
|-----------------------------------------------------------------------------------------------|--------------------------|----------------------|
| 1584                                                                                          | 1599                     |                      |
| 992 B                                                                                         | 1008 B                   |                      |
| 995 B 1586 2.12Dc   992 B 1584 4.14 Ja<br>31 Oct   1000 B 1591 9.19<br>988 1589 10 Nov   Oct. | 6.16 1008 B 1599 1       | •                    |
| 1589                                                                                          |                          |                      |
|                                                                                               | 1003 B 1594              |                      |
| 24 Dec<br>1584<br>3 Jan<br>1585<br>13.23<br>Dec.                                              | \$1592\$ \$ Oct          | 1006.B   1597   4.14 |
| 1585                                                                                          | <b>}</b> 1592 <b>{</b>   | 1597                 |
| 993.5                                                                                         | 1001                     | 1006.B               |
| 22 Nov                                                                                        | 1595 27 Aug 1001         |                      |
| \$1587\{ 22 Nov   993.5   2 Dec   994.2                                                       | 1595                     | ,                    |
| 986                                                                                           | 1004                     | •                    |
| 15.25<br>Jan.<br>20.30<br>Oct.                                                                | 98 25 July 1004          |                      |
| 1583                                                                                          | 1598                     |                      |
| 106                                                                                           | 1007                     |                      |
| 14 Dec   1584     3 Jan     12.23     Dec.                                                    | 1593 12.27 1007<br>Scut. | •                    |
| 1585                                                                                          | 1593                     |                      |
| 904. 2                                                                                        | 1003                     | ·                    |
| 997 B 1568 10.20<br>Nov<br>1005 1596 15.25<br>August                                          |                          |                      |
| 1588                                                                                          |                          |                      |
| 997 B<br>1005                                                                                 |                          |                      |

+ The first number indicates the Julian and the second the Gregorian initial date,

Third Chronological Tulle, continued.

XVIIch CENTURY.

From Anno Cali yugam 4702 to 4801.

From Anno Hejiræ 1010 to 1112. From A. D. 1601 to 1700.

/.

A. Hejirza N. S. 9 February 28 February 20 January Beginning 25 October 16 August 16 March 1 June 30 July 21 May 28 Noy. 4 May 19 Dec. 11 Nov. From Anno 1528 to 1622 Saca. 13 February Beginning A. Hejiræ 10 January 15 October 27 January 18 Nov. 23 August 6 August 6 March Wednesday 0. S 11 May 20 July 24 April 1 June 1 Nov. 9 Dec. ^. D. 1603 1616 1618 1639 1611 1670 1623 1631 1647 1654 1662 1678 1685 1693 Hejiræ 1049B 1020 1012 1028 1033B 1041B 1057B 1025B 1065 1073 1105 1081 1089 1097 1 February 11 February 4 Jan 1650 A. Hejiræ October 21 January Beginning 9 October 21 August s. Z 1 April 9 May 26 May 18 April 16 Nov. 27 June 14 July July 22 Sept. 15 Dec 1650 25 Dec 31 25 Dec 1649 A. Hejiræ O. S. 11 January Beginning 11 August 16 October Tuesday 3. 22 March 6 Nov. 4 July 8 April 112 Sept. 29 April 16 May 29 Sept. 17 June 21 July **{1650}** 1614 1629 1634 1637 1688 A. D. 1606 1621 1626 1642 1657 .1665 1673 1696 1681 060B3 Hejiræ 1068B 1061.1 1015 1093 1039 1044B 076B 1100 1036B 1052B 1084 1047 1092 1108 Anno 1031 1645 17 February 27 February A. Hejiræ N. S. 27 January Beginning 4 October 14 October 16 March 23 April 6 Sept. 11 June 20 Dec. 24 Sept. 29 June 6 April 119 July 1617 30 Dec. 1616 3 Jan. 19 Dec. 1617 29 Dec. 2 July 2 Dec. Beginning A. Hejiræ 1648 | 17 January 27 August
1 June 27 March March 0 S 14 Sept. 9 July 13 April Monday ' 22 June 22 Nov. 19 June 1683 |10 Dec. 1624 A. D. 1640 1660 1668 16321699 1609 1652 1676 1001 1691 1026.2 1027.B6 Hejiræ 1055B 1071B 1087B 1018 1034 1042 \*1050 1058 1063B 1079B 1103 1010 1095 1111 2 February 12 February A. Hejiræ N. S. 25 Dec 1649 4 Jan 16502 31 October Beginning 22 August 5 August 4 March 22 March 25 Dec. 29 Sept. 17 Nov. 4 July 10 May 30 May 17 June 12 Sept. 8 Dec. Beginning A. Hejiræ O. S. 23 February 21 October 12 August 12 March Sunday 1. 7 Nov. 15 Dec. 24 June 2 Sept. 19 Sept. 7 June 29 Nov. 30 April 20 May £1650{| 1655 1658 1663 1679 1686 1612 1619 1643 1666 1671 1694 A. D. 1604 1627 1635 1090 B 1098 B 1106 B Hejiræ 1066.B 060B3 1082 B 1074B 1001.1 1013 1029 1045 1053 1037 1031 1077

Third Chronological Table, continued.

## XVIIth CENTURY, continued.

| _                                        |                                | Thursday 5.                                                                   |                                                                      |                                              |                                                             | Friday 6.                                                                                     |                                                          |                                    | SO                                   | Saturday 7.                                                                                                                    |                                                                         |
|------------------------------------------|--------------------------------|-------------------------------------------------------------------------------|----------------------------------------------------------------------|----------------------------------------------|-------------------------------------------------------------|-----------------------------------------------------------------------------------------------|----------------------------------------------------------|------------------------------------|--------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------|
| Anno                                     | A. D.                          | Beginning<br>A. Hejiræ<br>O. S.                                               | Beginning<br>A. Hejiræ<br>N. S.                                      | Anno<br>Hejiræ                               | A. D.                                                       | Beginning<br>A. Hejiræ<br>O. S.                                                               | Beginning<br>A. Hejiræ<br>N. S.                          | Anno<br>Hejiræ                     | A. D.                                | Beginning A. Hejiræ O. S.                                                                                                      | Beginning<br>A. Hejiræ<br>N. S.                                         |
| 1014 B<br>1017<br>1022 B<br>1030 B       | 1605<br>1608<br>1613<br>1620   | 9 May<br>7 April<br>11 February<br>16 Nov.                                    | 9 May 19 May 7 April 17 April 1 February 21 February 6 Nov. 26 Nov . | 1011 B<br>1019 B<br>1026.2<br>1027B6<br>1035 | 1011 B 1602<br>1026.2 B 1610<br>1027 B6 \$1617<br>1035 1625 | 1011 B 1602 11 June 21 June 1026.2 1617 30 Dec 1617 29 Dec. 1617 1035 1625 23 Sept. 3 October | 21 June<br>26 March<br>9 January<br>29 Dec.<br>3 October | 1016 B<br>1024<br>1032<br>1040     | 1607<br>1615<br>162 <b>2</b><br>1630 | 18 April<br>21 January<br>26 October<br>31 July                                                                                | 28 April 31 January 5 Nov. 10 August                                    |
| 1038 B<br>1016 B<br>1054<br>1062         | 1628<br>1636<br>1644<br>1651   | 21 August 31 Augus<br>26 May 5 June<br>23 February 10 March<br>4 Dec. 14 Dec. | 31 August<br>5 June<br>10 March<br>14 Dec.                           | 1043<br>1051<br>1059<br>1067                 | 1633<br>1641<br>1649<br>1656                                | 28 June 8 July 2 April 5 January 15 January 15 January 10 October 20 October                  | 8 July<br>12 April<br>15 January<br>20 October           | 1048<br>1056<br>1064<br>1072       | 1638<br>1046<br>1653<br>1663         | 5 May<br>7 February<br>12 Nov.<br>17 August                                                                                    | 5 May 15 May 7 February 17 February 12 Nov. 22 Nov. 17 August 27 August |
| 1070<br>1078<br>1086<br>109387<br>1094.5 | 1659<br>1667<br>1675<br>\$1682 | 8 Sept.<br>13 June<br>18 March<br>31 Dec 1681<br>21 Dec 1682                  | 18 Sept. 23 June 28 March 10 January 31 Dec.                         | 1075<br>1083<br>1091<br>1096 B               | 1664<br>1672<br>1680<br>1684                                | 15 July<br>19 April<br>23 January<br>28 Nov.                                                  | 25 July 29 April 2 February 8 Dec.                       | 1085 B<br>1088<br>1093B7<br>1093B7 |                                      | 1669 22 May 1 June<br>1674 28 March 7 April<br>1677 24 February 6 March<br>31 Dec 1681 10 January<br>31682 31 Dec 1682 31 Dec. | 1 June 7 April 6 March 10 January 31 Dec.                               |
| 1102                                     | 1690                           | 27 Sept.<br>30 June                                                           | 5 October<br>10 July                                                 | 1099<br>1104 B<br>1107<br>1112 B             | 1692<br>1692<br>1695                                        | 28 October<br>2 Sept. 2<br>2 August<br>7 June                                                 | 7 Nov.<br>12 Sept.<br>12 August<br>18 June               | 1100 B 1697                        | 1689                                 |                                                                                                                                | 5 October 15 October 0 July 23 July                                     |

+ The new Style was introduced among the Protestant States of Germany in A. D. 1700, when 11 days were omitted in the month of Pebruary.

Third Chronological Table, continued.

XVIII CENTURY.

From Anno Cali yugam 4802 to 4901. From Anno 1623 to 1722 Saca. Wednesday 4. From Anno Hejira 1113 to 1215. From A. D. 1701 to 1800.

| Sund                            | Sunday 1.                                    |                                  |                                    | Mo                           | londay 2.                                    |                                             |                                  | Tue                          | - [                                      |                                             | -                                | *                             | wednesday 4.                                                      | Destruction                                 |
|---------------------------------|----------------------------------------------|----------------------------------|------------------------------------|------------------------------|----------------------------------------------|---------------------------------------------|----------------------------------|------------------------------|------------------------------------------|---------------------------------------------|----------------------------------|-------------------------------|-------------------------------------------------------------------|---------------------------------------------|
| Beginning<br>A. Hejiræ<br>O. S. |                                              | Beginning<br>A. Hejiræ<br>N. S.  | Anno<br>Nejiræ A                   | A. D.                        | Beginning A. Hejiræ O. S.                    | Beginning A Hejiræ N. S.                    | Anno<br>Hejiræ                   | A. D.                        | Beginning<br>A. Hejiræ<br>O. S.          | Beginning<br>A. Hejiræ<br>N. S.             | Anno<br>Hejiræ                   | A. D.                         | A. Hejiræ<br>O. S.                                                | A. Hejiræ<br>N. S.                          |
| 1702 17 May                     | ľ                                            | 1                                | 1119                               | 1707                         | 24 March<br>27 Dec 1714                      | 1 April 7 Jan.                              | 1116                             | 1704 2                       | 25 April                                 | 6 May                                       | 1113                             | 1709                          | 28 May                                                            | 8 June                                      |
| 19 February                     | 19 February                                  | 2 March<br>5 Dec                 |                                    | \$6171 <b>\$</b>             | 16 Dec 1715 27 Dec. 1 October 12 Octo        | ber S                                       | 1132                             |                              |                                          |                                             | 1126 B                           | 1711                          | ÷.                                                                | 17 January                                  |
| <b>1</b>                        | 29 August                                    |                                  | 1143                               | 1730                         | 6 July                                       | 17 July                                     | *1140                            | 1727                         | 8 August                                 | 16 August                                   | 1129                             | 1716                          | 5 Dec.                                                            | 16 Dec.                                     |
| 200                             | 3 June<br>8 March                            | 14 June<br>19 March              | 1151<br>1156 B                     | 1738 1                       | 10 April                                     | 10 April 21 April                           | 1115 B<br>1148                   | 1732                         | 13 June<br>13 May                        | 24 June<br>24 May                           | 1134 B<br>1137                   | 1721                          | 11 October<br>9 Sept.                                             | 22 October<br>20 Sept.                      |
|                                 | ec 17 47                                     | 1748 92 Dec 1747 2 Jan.          | 1159                               | 1746                         | 13 January                                   | 13 January 24 January                       | 11153 B                          | 1740                         | 18 March                                 | 29 March                                    | 1142 B                           | 1729                          | 16 July                                                           | e7 July                                     |
| 3.6                             | 756 15 Sept.                                 | 22 Det.<br>26 Sept.              | 1164 B                             | 1750                         | 19 Nov.                                      | 30 Nov.                                     | 1161.03                          | <b>}</b> 1748 <b>}</b>       | \$1748 22 Dec 1747 2 Jan. 1748 22 Dec.   |                                             | 8 0511 S                         | 1737                          | 20 April                                                          | 1 May                                       |
| 31000                           | 22 July<br>20 June<br>'6 April<br>29 January | 2 August 1 July 7 May 9 Februars | 1167<br>1172 B<br>1189 B<br>1183 B | 1753<br>1758<br>1766<br>1771 | 18 October<br>24 August<br>29 May<br>3 March | 29 October<br>4 Nept.<br>9 June<br>11 March | 1169 B<br>1177 B<br>1185<br>1193 | 1755<br>1763<br>1771<br>1779 | 26 Sept.<br>1 July<br>5 Aprill<br>8 June | 7 October<br>12 July<br>16 April<br>19 June | 1158 B<br>1166 B<br>1174<br>1182 | 1745<br>1752†<br>1760<br>1768 | 1752 23 Januari<br>1752 28 October<br>1760 2 August<br>1768 7 May | 3 February<br>3 Nov.<br>13 August<br>18 May |
| ကြောင်းက                        | 3 Nov.<br>8 August<br>13 May                 | 14 Nov.<br>19 August<br>25 May   | 1196 B<br>1204<br>1213             | 1781<br>1789<br>1797         | 6 Dec.<br>10 Sept.<br>15 January             | 17 Dec.<br>21 Sept.<br>26 January           | 1201                             | 1786                         | 13 October<br>18 July                    | 21 October<br>29 July                       | 111:0<br>11:08<br>12:06<br>12:14 | 1776<br>1778<br>1791<br>1791  | 10 March<br>16 Nov.<br>20 August<br>25 May                        | el March<br>26 Nov.<br>31 August<br>5 June  |

# The BRIFISH KEFORMATION of the Kalendar. In the year of Christ 1752 the Julian Kalendar was abolished by Act of Parliament (28th George II) and elever days were expunged after the 2d of September of that year, by accounting the 3d to be the 14th day of the month. Public Others in British India, when converting Indian, of Mahommedan dates, ascending before that Epoch, THE EUROPEAN ACCOUNT, MINST THEIS CARE THEN TO THE Old Style, if they mean to have the date as then kept in England. Kingerer all the other Christian States of Burope (excepting Russia) followed the Gregorian Kalendar before that Epoch,

Third Chronological Table, continued.

XVIIIth CENTURY, continued.

| ,           |                                 |                                                                                                                                          |                                                                  |                                              |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------|---------------------------------|------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------|----------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|             | Beginning<br>A. Hejiræ<br>N. S. | 25 Apr<br>28 Jan<br>2 Nov<br>7 Aug                                                                                                       | 1 May 15 May 15 Hebruary 15 Pebruary 20 Nov. 25 August 25 August | 30 May<br>4 April<br>4 March                 | 8 January<br>28 Dec.<br>7 Dec.<br>13 October<br>18 July                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |
| Saturday 7. | Beginning A. Hejiræ O. S.       |                                                                                                                                          | 1 May 4 February 9 Nov.                                          | 19 May<br>24 March<br>21 February            | \$\frac{1780}{17 Dec 1779} & Junuary \$\frac{1779}{17 Dec 1730} & B. Dec. \$\frac{1780}{1782} & 2 October \$\frac{7}{1795} & 7 July \$\frac{18}{18} July \$\frac{18}{18} Jul |
|             | A. D.                           |                                                                                                                                          | 1736<br>1744<br>1751<br>1759                                     | 1767<br>1779<br>1775                         | 1780<br>1782<br>1787<br>1795                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|             | Anno                            | 1117 B<br>1125<br>1133<br>1141                                                                                                           | 1149<br>1157<br>1165<br>1173                                     | 1181<br>1186 B<br>1189                       | 1195.5<br>1197<br>1202 B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| out that u. | Beginning<br>A. Hejiræ<br>N. S. | & 5                                                                                                                                      | 10 April<br>13 January<br>18 October<br>23 July                  | ary                                          | 10 Sept. 9 August 15 June                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Friday 6.   | Beginning<br>A. Hejiræ<br>O. S. | 1120 B   1708   12 March   23 March   1127.2   27 Dec 1715   7 Jun.   128B6   1723   20 Sept.   1 Octob   1144   1731   25 June   6 July | 30 March<br>2 January<br>7 October<br>12 July                    |                                              | 1790 30 August 1793 20 July 4 June                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|             | A. D.                           | 1708<br>1715<br>1723<br>1731                                                                                                             | 1736<br>1747<br>1754<br>1762                                     | 1770<br>1778<br>1785                         | 1790<br>1793<br>1798                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|             | Anno<br>Hejiræ                  | 1120 B<br>1127.2<br>1128B6<br>1136 B<br>1144                                                                                             | 1152<br>1160<br>1168<br>1176                                     | 1184<br>1192<br>*<br>1200                    | 1205 B<br>1208<br>1213 B                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|             | Beginning<br>A. Hejiræ<br>N. S. | 17 May<br>15 April<br>19 February<br>21 Nov.                                                                                             | 29 August 3 June 8 March 11 Dcc.                                 | 15 Sept.<br>20 June<br>25 March<br>8 Jan.    | <b>√</b>   ₽                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Thursday 5. | Beginning A. Hejiræ O. S.       | 6 May 17 May 4 April 15 April 8 E-bruary 19 Februa 13 Nov. 21 Nov.                                                                       | 18 August<br>23 May<br>25 February<br>30 Nov.                    | 1757 4 Sept.<br>1765 9 June<br>1773 14 March | 217 Dec 1780 28 Dec. 21 Sept. 2 Octob 26 June 7 July                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| I.          | A, D.                           | 1703<br>1706<br>1711<br>1718                                                                                                             | 1726<br>1734<br>1742<br>1749                                     | 1757<br>1765<br>1773<br>1773                 | 1788                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|             | Anno<br>Hejiræ                  | 1115 B<br>1118<br>1123 B<br>1131 B                                                                                                       | 1189 B<br>1147 B<br>1155<br>1163                                 | 1171<br>1179<br>1187<br>1194B7               | 1195.5<br>1203<br>1211                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |

Third Chronological Table, continued.

From Anno II jiræ 1216 to 1318. From A. D. 1801 to 1900.

| <b>:</b>                           | 1-          |             |                                 | <del></del> ,                     |                      |                       |          |            |                | •                        |                     |                     |                               | •                 |                     |            |
|------------------------------------|-------------|-------------|---------------------------------|-----------------------------------|----------------------|-----------------------|----------|------------|----------------|--------------------------|---------------------|---------------------|-------------------------------|-------------------|---------------------|------------|
| From Anno Cali yugam 4902 to 5001. | 22 Saca.    | •           | Beginning<br>A. Hejiræ          |                                   | 11 March             | 14 Dec.<br>20 October | 18 Sept. | 25 July    | 29 April       | I February               |                     | 11 August           | 16 May<br>18 February         | 23 Nov.           | 28 Anguet           | 2 June     |
| o Cali yugan                       | Wednesday 4 |             | Beginning A. Hejiræ             |                                   | 27 February 11 March | 2 Dec.                | o Sept.  | 13 July    | 17 April       | 20 January<br>25 October |                     | 30 July             | 4 May<br>6 February           | 11 Nev.           | 12                  |            |
| m Ann                              |             |             | A. D.                           |                                   | 1807                 |                       | 705      | 1827       | 1835           | 1843 $1850$              | 1                   |                     | 1874                          | 1901              | 1889                | 1897       |
| <b>년</b>                           |             |             | Anno Hejiræ                     | 000                               | * 22.5               |                       | 2021     | 1243 B     | 1251 B         | 1259 B<br>1267 B         | • 3                 | 1275                | 1283                          | 1233              | 1307                | 5151       |
|                                    |             | 1           | Beginning<br>A. Hejiræ<br>N. S. | A Man                             | 6 Echeman            | 11 Nov.               | 16m 9m-  | 22 June    | 21 May<br>97 M | 11 February 23 February  | 1                   | <del>کم</del> .     | 4 October   9 July   18 April | nider or          | 16 January   1307   |            |
|                                    | Tuesday 3.  | -           | A. Hejiræ O. S.                 | 22 April                          | 25 January           |                       |          | Ito June   | 9 May          | 11 February              | 29Dec. 1844 10 Jan. | 18Dec. 1845 30 Dec. |                               |                   | 4 January 9 October |            |
| ۲۲.                                | •           |             | A. D.                           | 1802                              | 1810                 | 1817                  |          | 1000       | 1838           | 1841                     | \$1845              | 1853                |                               |                   | 1881                | 1892       |
| XIX& CENTURY.                      |             |             | Anno<br>   Hejiræ               | 1217                              | 1225                 | 1233                  | 10 12 0  | 1040       | 1254 B         | 1257                     | 1261.6              | 1270 B              | 1278 B <br> 1286 B            | 1                 | 1302                | 1510       |
| XIX                                |             | Desire      | A. Hejira<br>N. S.              | 1 April                           | G                    | 9 October<br>14 July  | 18 4 21  | 29 Januari | 27 Nov.        | 27 October               | 1 Sept.             | 6 June              | 11 March<br>15 Dec.           | 10 8000           | 31 June             |            |
|                                    | Monday 2.   | 1 Reginning |                                 | 20 March                          | 23 Dec 1812 4 Jan.   | 27 Sept.<br>2 July    | A April  | 10 January | 15 Nov.        | 15 October               | 20 August           | 25 May              | 28 February<br>3 Dec.         | 7 North           | 12 June             | <b>à</b> . |
|                                    |             |             | A. D.                           | 1805                              | <b>{1813</b> }       | 1820                  | 1836     | 1844       | 1848           | 1631                     | 1856                | 1864                | 187 <u>9</u><br>1879          | 1847              | 1595                |            |
| [31 <b>8,</b>                      |             |             | Anno<br>Hejiræ                  | 1200                              | 1228. 2.             | 1236<br>1241          | 1252     | 1260       | 1205 B         | 1268                     | 1273 B              |                     | 1289 B                        | 1.305             | 1313                |            |
|                                    |             | Beginning   |                                 | 1808 16 February 28 February 1200 | 3 Dec.               | 7 Sept.               | 17 March | 20 Dec.    | 21 Sept.       | 31 July                  | 29 June             | 5 May               | 3 April<br>7 February         | 12 Nov.           |                     | es andy    |
| From A. D. 1801 to 1900.           | Sunday 1.   | Beginning   | A. Hejiræ<br>O. S.              | 16 February                       | 1815 21 Nov.         | 26 August<br>31 May   | 5 March  | 8 Dec.     |                | IB July                  | 1862 17 June        |                     | 26 January                    | 1882   31 October | 5 Angüst            | year or    |
| D. 180                             | -           | _           | A. D.                           | 1808                              | 1815                 | 1823<br>1831          | 1839     | 1846       |                | 1859                     | 1862                | 1867                | 1870                          | 1                 |                     | 1898       |
| From A.                            |             |             | Anno                            | 1223                              | 1231                 | 1239                  | 1255     | 1363       | 1271           | 1276 B                   | 1279                | 1284 B              | 1287<br>1292 B                | 1300 B            | 1308 B              | 0101       |

Third Chronological Table, continued.

XIXth CENTURY, continued.

|             | Beginning<br>A. Hejiræ<br>N. S.  | 23 April<br>26 January<br>31 October<br>5 Apriet                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 10 May<br>12 February<br>17 Nov.            | 27 May<br>1 March<br>5 J muary<br>26 Dec.<br>4 Dec.                                                                                                                          | 10 October                                   |
|-------------|----------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------|
| Saturday 7. | Beginning<br>A. Hejiræ<br>O. S.  | 1803 11 April<br>1811 14 January<br>1818 19 October                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ary<br>1st                                  | 1865     15 May     27 May       1873     17 February     1 Marc       \$1878     24 Dec 1877     5 Junu       \$14 Dec 1878     26 Dec.       \$1880     22 Nov.     4 Dec. | 1303 B 1885 28 S.pt.                         |
| တို         | A. D.                            | 1803<br>1811<br>1815                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1834<br>1842<br>1849<br>1857                | 1865<br>1873<br>\$1878<br>1880                                                                                                                                               | 1885<br>1893                                 |
|             | Anno<br>Hejiræ                   | 1218 B<br>1226 B<br>1234<br>1949                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1250<br>1258<br>1258<br>1266<br>1274        | 1282<br>1290<br>129513<br>1296.5<br>1298                                                                                                                                     | 1303 B 1885<br>1311 B 1893                   |
| ,           | Beginning<br>A. Hejiræ<br>N. S.  | ~∽                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        | ) er                                        | 24 April<br>28 January<br>2 Nov.<br>7 Sept.                                                                                                                                  | 7 August<br>12 June .<br>12 May              |
| Friday 6,   | Beginning<br>A. Hejiræ<br>O. S.  | 1228. 2   1806   9 March   21 Marc   1228. 2   1813   23 Dec 1812   4 Jan.   129 B 6   1821   16 Sept.   237 B   1821   16 Sept.   28 Sept.   248.   28 Sept.   248.   28 Sept.   248.   28 Sept.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248.   248. | h<br>841<br>815<br>915                      | 12 April<br>16 January<br>21 October<br>25 August                                                                                                                            | 1891 26 July<br>1896 31 May<br>1899 30 April |
|             | A. D.                            | 1806<br>1813<br>1821                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      | 1837<br>1845<br>1852<br>1860                | 1                                                                                                                                                                            | 1891<br>1896<br>1899                         |
|             | Anno<br>Hejiræ                   | 1221 B 1806<br>1228. 2   1813<br>1259 B 6   1821<br>1237 B 1821                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           | 1253<br>1261. 6<br>1262 B.S<br>1269<br>1277 | 1285<br>1293<br>1301<br>1306 B                                                                                                                                               | 1309<br>1314 B<br>1317                       |
|             | Beginning<br>A. H. jiræ<br>N. S. | 14 May 12 April 16 February 16 January                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | 26 August 31 May 5 March 9 Dec.             | -e                                                                                                                                                                           | 30 Sept.<br>5 July                           |
| Thursday 5. | Beginning<br>A. Hejiræ<br>O. S.  | 2 May 31 March 4 February 4 January                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | ıst                                         | 1 Sept. 13 Sept. 6 June 18 June 11 March 23 Mar. 24 Dec 1877 5 Jan. 14 Dec 1878 25 Dec.                                                                                      | 18 Sept.<br>23 June                          |
| L           | A. D.                            | 1801<br>1804<br>1809<br>1812                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              | 1832<br>1832<br>1840<br>1847                | 1855<br>1863<br>1871<br>\$1878                                                                                                                                               | 1886<br>1894                                 |
|             | Anno<br>Hejiræ                   | 1216 B<br>1219<br>1224 B<br>1227                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          | 1240 B<br>1248 B<br>1256 B                  | 1272<br>1280<br>1288<br>1298B.7<br>1295B.7                                                                                                                                   | 1304                                         |

:

# END OF THE CHRONOLOGICAL TABLES.

I SHALL conclude this work by giving a short method for finding the initial root and feria (Soota dina) of any Tamul Solar year, past or to come, by means of the preceding Chronological Tables, and without reference to any other Rule whatsoever.

RULE.

ľ.

"If the proposed year is not to be found in any of the three centuries contained in the first Chronological Table, raise or lower it by adding to, or subtracting from its numeral, as many times 89 years, as will produce a year which is registered in the Table."

II.

"Take the root of the beginning of the year thus obtained, out of the Xith column of the first Chronological Table, and subtract, or add inversely from what you did before, as many times 1g 21v 15p, as you have added or subtracted 89 years; and the sum or difference will give the Soota dina required."

The accompanying small Table will considerably abridge the above process. It is to be entered with the figures which express the number of times, that you have added or subtracted 89 years from the numeral of the proposed one, in order to raise or lower it, to one which is to be found in the Chronological Table; and the column of Roots will furnish that which is applicable to the question.

The following examples will suffice for shewing the use of these Rules and Table, in all possible cases.

### EXAMPLE I.

Let us suppose that the years 1847, and 1764 of the Christian æra, are not to be found in the first Chronological Table, although the contrary be the case.

| Number of Cycles. |              | 1  | Root       | S.           |
|-------------------|--------------|----|------------|--------------|
| 1                 | Years,<br>89 | G. | v.<br>21   | P.<br>15     |
| 2                 | 173          | 2  | 42         | 30           |
| 3                 | 257          | -1 | 3          | 4.5          |
| 4                 | <b>3</b> 56  | 5  | 25         | 0            |
| 5                 | 4 i 5        | 6  | 40-        | 15           |
| 6                 | 53 <b>1</b>  | 8  | 7          | 30           |
| 7                 | 623          | 9  | <b>2</b> S | 45           |
| 8                 | 712          | 10 | 50         | 0            |
| 9                 | 801          | 12 | 11         | 15           |
| 10                | 690          | 13 | 32         | 30           |
| 11                | 979          | 14 | 53         | 45           |
| 12                | 1008         | 16 | 15         | $\mathbf{G}$ |
| 13                | 1157         | 17 | 30         | 15           |

Dispose the numerals of these years separately, and see how many times it may be necessary to subtract or add 89 years to obtain one which is registered in the Chronological Table. Suppose that in both cases it is one; then proceed as follows:

Now as we have used only one cycle of 89 years, the root to be used in both cases is (04) 18 217 150 which is registered in the small Table opposite to 1 cycle, and 89 years.

Take out of the Chronological Table the initial roots which belong to the years 1758 and 1853 respectively, and proceed thus:

for a proof of which look in the same Chronological Table for the initial roots of the proposed years 1847, and 1764 at pages xxv and xxiv; and you find them to be the same as above, shewing that the Tamul Solar year of the Cali yug 4948 ends, and 4949 (each answering to the above Christian years) begins on a Sunday, Sydereal, and Monday Civil accounts; and that the year of the Cali yug 4865 ends and 4866 begins on a Monday Sydereal and Civil accounts.

### EXAMPLE II.

Wanted the initial feria or Soota dina, of the years of the Cali yug which concur with A. D. 2311 and 683.

Proceeding as we did before, we find that six cycles of 89 years suffice for lowering the first of the two proposed years; and thirteen, to raise the last, to years to be found in the Chronological Table. Referring therefore to the small Table with the numbers 6 and 13, in the first column, the rule will be,

both of which indicate years to be found in our Chronological Table; whose roots at pages xxiv and xxv will be found as follows:

which shews that the Solar year 5413 of the Cali yug which answers to A. D. 2311 began on a Wednesday Sydereal, and Thursday Civil accounts; and that the year of the Cali yug 3785 which answers to A. D. 683 commenced on a Friday Sydereal, and Saturday Civil accounts.

The proofs of these results may easily be found by expounding the same Soota dina by means of the Tables XLVIII, page 63 and Example page 65 of the Astronomical Tables referred to in the Kala Sunkalita.

List of the Authorities, and Individuals who have patronized the Author, and subscribed to this Work. (\*)

### Collectively.

The Supreme Government of India.
The Government of Fort St. George.
The Government of Bombay.
His Majesty's Government of Ceylon.

The Board of Superintendence for the College of Fort St. George.

The College at Poona.

The Madras Literary Society.

### Individually.

The Hon'ble Major General Sir Thomas Munro, Bart. K. c. B. Governor of Fort St. George.

The Hon'ble Mountstuart Elphinstone, Governor of Bombay.

The Hon'ble Robert Fullerton, Esq. Governor of Prince of Wales Island.

His Excellency Lieutenant General the Hon'ble Sir Lowry Cole, a. c. B. Governor of Mauritius,

Sa Seigneurie, Mons. le Comte Du Puy, Pair de France, Governor of the French Settlements in India.

The Hon'ble Sir Charles Grey, Knt. Chief Justice in Bengal.

The Hon'ble H. S. Græme, Esq.

The Hon'ble J. H. D. Ogilvie, Esq. Members of the Government of Fort St. George.

The Hon'ble J. Cochrane, Esq.

Lieutenant General Thomas Bowser, Commanding the Madras Army in Chief.

### A

George Alexander, Esq. Prince of Wales Island.

J. A. Arbuthnot, Esq. of the House of Arbuthnot and Co.

J. Aitkin, Esq. H. C. Medical Service, Assay Master.

### B

J. H. Baber, Esq. Resident at Darwar.

John Babington, Esq. Principal Collector in Canara.

Lieutenant Colonel V. Blacker, c. B. Surveyor General of India.

A. W. Blane, Esq. Collector of His Majesty's Customs, Mauritius.

Major Briggs, Resident at the Court of Sattara.

Captain Burney, Prince of Wales Island.

### C.

Lieutenant Colonel Carfrae, Private Secretary to the Hon'ble the Governor of Fort St. George.

J. A. Casamaijor, Esq. Judge in the Island of Seringapatam.

Captain T. Chase, Commanding the Hon'ble the Governor's Body Guard.

William Chaplin, Esq. British Commissioner at Poona.

Richard Clarke, Esq. Member of the Board of Revenue, and Senior Member of the Board of Superintendence for the College of Fort St. George.

<sup>(\*)</sup> A part of the Edition of the Kala Sankalita having been placed at the Author's di-posal, was the occasion of this subscription.

R. Clive, Esq. Secretary to Government, Military Department.

The Hon'ble W. A. Clubley, Esq. Member of Government Prince of Wales Island.

The Hon'ble Arthur Cole, Resident at the Court of Mysore.

Herbert Compton, Esq. Advocate General at Madras.

Lieutenant Colonel T. H. S. Conway, c. B. Adjutant General of the Madras Army.

Major Cubbon, Deputy Commissary General.

D.

J. A. Dalzell, Esq. Post Master General at Madras. Captain Davidson.

J. Dent, Esq. Secretary to the Board of Revenue, and Member of the Board of Superintendence for the College.

Ε,

Lieutenant Edward Elliot, Royal Engineers.

F.

F. Fauquier, Esq. Commissioner for the affairs of His Highness the Nabob.

Lieut. Colonel J. S. Fraser, British Commissioner for the Foreign Settlements on the Coast of Coromandel.

G.

Edward Gordon, Esq. of the House of Gordon and Lys.

F. A. Grant, Esq. Senior Judge of the Court of Sudr Udawlut.

Captain J. L. Grant, Master Attendant at Madras.

II.

Major Hanson, Deputy Quarter Master General.

D. Hill, Esq. Chief Secretary to Government.

George Hyne, Esq. H. C. Medical Service, Deputy Assay Master.

1

The Hon'ble R. Ibbetson, Esq. Member of Government Prince of Wales Island.

L.

Lieutenant Lake, Madras Engineers, Town Major Prince of Wales Island.

The Reverend T. Lewis, Chaplain at the Presidency.

Lieut. Colonel J. Limond, Commanding the Madras Artillery.

M.

Major Macdonald Kinneir, Envoy at the Court of Persia.

J. M'Kerrell, Esq. Mint Master, and Member of the Board of Superintendence for the College.

J. M. Maclcod, Esq. Secretary to Government Public Department.

A. D. Mainjy, Esq. of Prince of Wales Island.

Richard A. Maitland, Esq. Magistrate.

Sir Charles Theo. Metcalfe, Bart. Resident at the Court of Hyderabad.

Captain D. Montgomerie, Deputy Surveyor General.

George Moore, Esq. Civil Auditor.

N.

Major J. Nixon, Deputy Judge Advocate General.

Lieut, Colonel R. B. Otto, Quarter Master General of the Madras Army.

P.

Lieut. Colonel J. Prendergast, Military Auditor General.

R.

F. A. Robson, Esq. Treasurer of the Government Bank, Captain H. D. Robertson, Collector of Poona. J. W. Russell, Esq. Collector and Magistrate of Cuddapab.

S.

J. A. R. Stevenson, Esq. Sub Collector of Poona.
William Stokes, Esq. Secretary to Government Revenue and Judicial Department.
J. M. Strachan, Esq. of the House of Arbuthnot and Co.

Captain M. Sim, Superintending Engineer at the Presidency.

T.

J. F. Thomas, Esq. Head Assistant to the Register to the Court of Sudr Udawlat.

J. Tod, Esq. Commissioner for the affairs of His Highness the Nabob.

J. G. Turnbull, Esq. Accountant General.

V.

The Venerable Edward Vaughan, Archdeacon of Madras.

F. E. Viret, Esq. Private Secretary to His Excellency the Governor of Mauritius.

The Hon'ble Mynheer H. Valraad Von Schooten, Chief of the Dutch Esttlements on the Coast of Coromandel.

W.

Major Wetherall, Military Secretary to the Commander in Chief.

The Author hopes that he does not transgress against the rules of discretion in testifying at this place his gratitude to Lieut. Colonel Otto, who, notwithstanding the calls of his important office, and personal studies, has, during the Author's absence from Madras, kindly devoted many of his leisure hours to the supervision of the proof-sheets of this publication, a task which, from the nature of the work, was unavoidably very trying and tiresome. To that Gentleman, therefore, the present Edition ones chiefly the degree of correctness which it may be found to possess.

The names of the following Gentlemen are here added, having been communicated too late for insertion in the general list. The Author takes this opportunity for stating, that to Mr. Oliver and Mr. Campbell's support, this work (in its present shape) owes chiefly its existence.

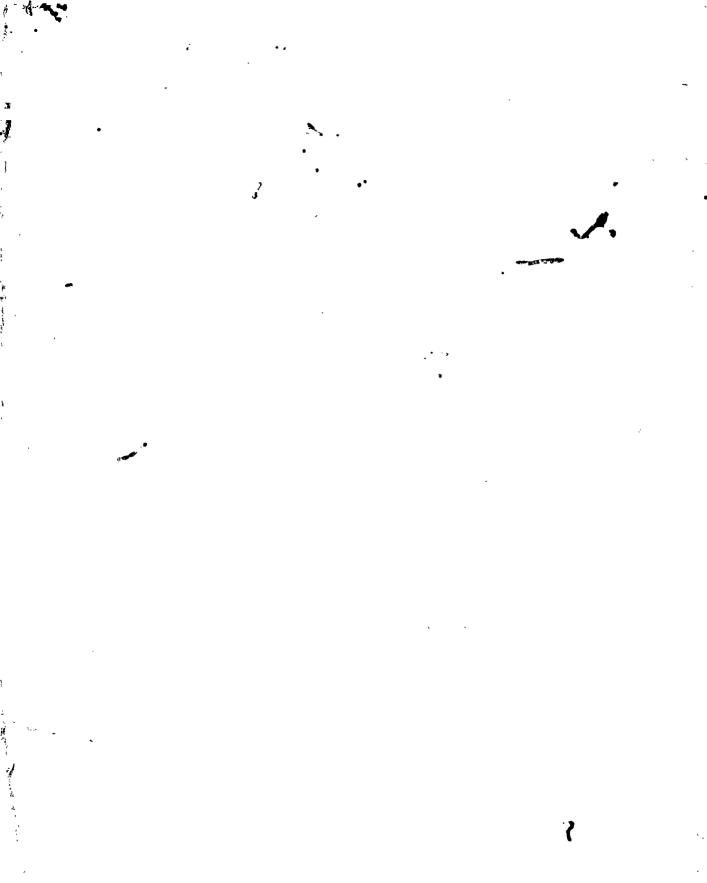
William Oliver, Esq. Judge of the Court of Sudr Udawlut.

A. D. Campbell, Esq. Judge of the Provincial Court of Chittorn.

Ram Mehan Roy, a learned and distinguished inhabitant of Calcutta.







William S

Central Archaeological Library,

NEW DELHI

Call No. 529.0954/ War.

Author- Warren, J

Title in A mon the Various

modes According to which

Baromer do: Date of Issue Date of Return